This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

LSoc 1808.6

Harvard College Library

FROM

The Society

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

NOTICE.

It is to be understood that the Society is not responsible for any opinion or statement of facts in the Essays published in this Volume. The Authors of the several Papers are alone answerable for their contents.

5-7-11-41

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

VOL. V.

DUBLIN:
HODGES, FOSTER, & CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, & CO. EDINBURGH: JOHN MENZIES.
1870.

DUBLIN:
Printed at the University Press,
BY M. H. GILL.

No. XXXV.] [Price 2s.

Soc 1855.6

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

CONTENTS:

PAGE.
1. Mr. Hoare on the Resources of the Sea Fisheries of Ireland, ... 2
2. Mr. Andrews on the Herring Fisheries of Ireland, ... 12
3. Dr. Barry on Submarine Earthquakes and Volcanoes, ... 26
4. Dr. Moore on Orchis Mascula with Double Flowers, ... 34
5. Dr. Mapother on Labourers' Dwellings, ... 35
6. Return of Donations to the Royal Dublin Society, ... 49
7. Intelligence, ... 62
Appendix—Meteorological Journal from July, 1865, to August, 1866, ... i

---

DUBLIN:
HODGES, SMITH, AND CO., 104, GRAFTON-STREET
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.
1866.

M. H. Gill, Printer to the Royal Dublin Society.

Soc 1862.6

HARVARD COLLEGE
AUG 2 1917
LIBRARY

The Society

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

The Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Registrar:—

Life Membership, ...	£21	0	0
Annual Membership (with £3 3s. Entrance Fee),	2	2	0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15s.

I.—MEETINGS OF THE SOCIETY.

1. *Stated and Ordinary Meetings.*

The Society meets at 2 o'Clock P. M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday in November.

2. *Evening Scientific Meetings.*

Meetings of the Society and of the Associated Societies, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session. The business is conducted in the following sections:—

I. AGRICULTURE and Rural Economy, and Horticulture.

II. FINE ARTS.

III. NATURAL SCIENCES, including Zoology, Botany, Physiology, Mineralogy, Geology, Physical and Descriptive Geography.

IV. EXPERIMENTAL SCIENCES, including Physics, Chemistry, Physiology, Meteorology, and the Mechanical Arts.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society, and in the Quarterly Journal of Science.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5s. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6*d*. each; or to twelve for 5s., available for any of the ordinary Meetings throughout the Session.

THE COUNCIL AND COMMITTEES.

The Council, which comes into office in April, meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

Six Standing Committees are annually elected, as follows:—1. Agriculture; 2. Botany; 3. Fine Arts; 4. Library; 5. Natural History; 6. Practical Science.

[*For continuation, see page* 3 *of Cover.*

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

I.—*The Resources of the Sea Fisheries of Ireland.* By JOHN HOARE.

[Read January 15, 1866.]

THE Sea Fisheries of Ireland, from time immemorial, are well known to have been subjects of much attention to the naturalist, the cosmopolitan, and commercial men. They have always been treated as a national element whence great wealth may be derived; and the immense employment obtained in their development renders this question of paramount importance.

With respect to the natural productiveness of the Irish Fisheries, different opinions are entertained. By some it is alleged that the abundance of fish said to exist off our coasts is greatly exaggerated; such persons, in support of their opinion, ask, if the supplies are so colossal as represented, why it is that so few are captured. The Commissioners appointed in 1868 to inquire into the Sea Fisheries of the United Kingdom, in their Report, recently published, take this view of the question; but to those acquainted with the manner in which they conducted their inquiries in this country, such assumption will not cause surprise. The extent of their knowledge concerning the Irish Fisheries may be inferred from the following statement (p. lxiii), that "foreign fishermen have never been known to fish off the coasts of Ireland." If we refer to any period extending over thirteen centuries, of which we have historical and traditional records, we find, at every place where the Fisheries were properly and systematically worked, there is undeniable evidence of a superabundant supply, and the immense quantities taken sustain the contrary argument. Such being the case, those who entertain opposite views should first inquire the amount of success that has arisen in each instance from the endeavours made in their prosecution. In order to facilitate subsequent investigation in this respect, I will take a retrospective glance at a few of the principal features, which, I anticipate, will be sufficient to establish that the productiveness of the Sea Fisheries of Ireland is not exaggerated.

In former years, their resources and wonderful productiveness excited the envy of foreign nations. During the ninth and tenth centuries the Danes were sensible of the great wealth accruing from their development, and by these means they soon established an extensive trade, which afterwards proved how correct was their judgment in their prosecution, by which they were enabled to carry to Ireland luxuries then only known in foreign countries. A great trade was soon established, which continued to flourish until the avarice of the Danes goaded the primitive Irish inhabitants to resent the encroachments they were then making on their territories. Local retaliation led to universal war, and consequently the destruction of commerce ensued. From this time down to the last century, the country was seldom free from demoralizing influences of conflicting parties—a national calamity, which prostrated every branch of industrial vocation, but more particularly affected the vast, and under the circumstances sensitive, fields of employment the Fisheries of the country embraced.

Many authorities can be quoted to show the immense yield of the Sea Fisheries from the sixth century to that epoch when the first English settlers arrived in this country. From the circumstance of frequent mention in the grants given by Henry II. of "Fishery chases at ports and harbours," we may safely deduce that they comprised a nucleus from which was derived considerable revenue.

In the reign of Edward I. Flemish vessels, laden with cargoes of Irish fish, were seized by order of that king at Waterford, Youghal, and Cork. During the Scotch wars, in the fourteenth century, large quantities of fish and other provisions were sent from Ireland to supply the English forces in that country.

In 1304 several Commissioners were appointed to look after the Fisheries, and to see if the ordinances were properly carried out.

In 1325 large numbers of French fishing boats were seized on the south coast of Ireland, in consequence of the meditated invasion by the French of Aquitaine, then a dukedom annexed to the English crown. On the Great Pipe Roll of 1370 we find that herrings and other sea fish were amongst the commodities taxed for the "maintenance of the land." Five years later a grant was made to the Corporation of Dublin of the customs and duties upon all fish brought for sale from Skerries and Arklow.

About this time the Irish Fisheries were eclipsing those of England; and the fish trade of Yarmouth, London, Rye, &c., was falling into decay. In order to encourage their revival, after October, 1432, landlords, hosts, &c., were ordered to desist from the practice of forestalling herrings or other fish on pretence of custom or charter, all such being thereby abrogated; and they were on no account to hinder fishermen, &c., natives or foreigners, in friendship with the King, selling or buying as they might think proper. However, the Fisheries of England had been unproductive for a considerable time; as we find in D'Alton's "History of Drogheda," that in the year 1422 English merchants from Bristol purchased large quantities of herrings at Drogheda; and four years later red herrings cost 2*s.* 4*d.* per hundred in England, which price, in those days, must be considered exorbitant.

Anderson, in his "Annals of Commerce," remarks, that in 1437 the Irish exported large quantities of fish (herrings, hake, and salmon) to Brabant, which was then the greatest commercial emporium in the world. Twenty-eight years after this date, the Irish statute of the 5 Edward IV., chapter 6, provides that "no foreign vessel shall fish in Ireland without paying license;" collectors of this tax "to account before the Chief Governor, and not before the barons." Foreign fishing boats at this time were amazingly numerous on the Irish coast, for which concession they paid a liberal tribute to the Irish chiefs or barons, exclusive of the foregoing. In 1556 Philip II. of Spain paid £1000 a year for permission to fish on the northern coast of this country; and so great was the quantity of fish imported to Spain from Donegal, that Tyrconnell, a great chief in those days, was called by the Spaniards "the King of the Fish."

How contrary was the state of the English Fisheries at this time may be inferred from the Act 33 Henry VIII., which describes the bad custom of the people and fishermen on the coast of England, who, instead of fishing for themselves, went in their own boats, and bought fish on the Irish coast from the Swedes, Dutch, Irish, &c. It was now enacted, That whosoever should buy any fish in that manner, to be put to sale to any persons within the realm of England, should forfeit for every time £10.

In the charters granted by Queen Elizabeth to Youghal and several other towns, it is distinctly stipulated that each fishing boat should contribute a certain quantity of herrings annually for the maintenance of the quays and repairing the walls of the towns.

But the Spanish invasion and the war that ensued annihilated the Fishery for several years. However, on the restoration of peace the Fisheries were resumed with increasing energy. The Spanish, French, and Dutch vessels increased to an almost incredible number; the tribute paid by them for permission to fish was enormous, as we know, on unquestionable authority, the Dutch at this time gave £30,000 for such concession. We are also informed, that at the time now under our consideration the Cornish boats fished with great success in our seas; and so numerous were they, that any quantities of goods could be conveyed from Cork to England at the nominal freight of 8*d.* per cwt. "by fishing boats returning home." (See Tracts relating to Ireland, by the Irish Archæological Society, 1851.) Indeed, the Cornishmen found this fishing so profitable, that a great number of them established a colony at Scilly, near Kinsale, where their posterity continue to prosecute the fishery to the present day.

On the east coast the Scotch emulated the example of foreigners, where their numbers were equal, and their success equivalent to the Dutch on the west, the Spaniards on the north, and the French and English on the south.

Sir John Temple, in the "History of the Irish Rebellion of 1641," remarks that at that time "The Scotch fishermen, who lay with their boats in great numbers within the bay [Dublin], fishing for herrings, with much forwardness made an offer to the State to bring 500 of their men ashore to be put in arms, and do present service—a proposition at that season most acceptable—were so strangely affrighted one evening with false alarm, as that in the night on a sudden they put to sea, and quite disappeared on these coasts till the following year."

Of the native fishermen we have but limited information; nevertheless, in the fields where these gleanings were collected many abstract matters are to be found, sufficient to prove that they were not insensible of the benefits derivable from this source of national wealth, in which they largely participated.

The Fisheries continued to be extensively prosecuted until the civil wars of Charles I. annihilated their working, and consequently the demoralization attending the wars in the reign of Elizabeth was again experienced; and the result shows how this sensitive branch of employment has always been affected by the ruthless hand of war, and the uncompromising viciousness of belligerent parties. Richards, in his "History of the County of Wexford" (written in 1682), states that prior to the rebellion of 1641 there were annually made, and entered into the custom house in that town, 100,000 barrels of herrings, and nearly a similar quantity made (probably for inland consumption) that were not entered. Thirty years subsequently, he remarks, "there were not 200 barrels made in the whole towne." Doubtless, the great deterioration here recorded would be attributed to a diminution in the natural supply; but we find in Prendergast's "Cromwellian Settlement," that the "fishermen and gillers of the herrings" were, to a great extent, exterminated under the "transplanting law." In this instance we have undoubted authority that the Irish at this time thoroughly understood the Dutch method of curing herrings, of which system the Scotch possessed but imperfect knowledge until nearly 200 years later.

Nor should the extermination of the Irish fishermen cause surprise, as at this time the Cromwellian Parliament were inundated with petitions from Yarmouth, and other English fishing stations, praying that the Irish Fisheries might be discouraged, from one of which I take the following extract:—"There is to be seen yearly at Wexford no less than 200 sail of ships at a time—part English, part French, but most part Dutch—taking in herrings and other provisions, where a mesh of herrings, containing about 500, is commonly sold for 4*s*., often under, and sometimes higher; and about a mesh fill a barrel; moreover, cod and other fish are sold for 4*d*. and 5*d*. a piece; so that if this is permitted, and no redress found, it will be folly to catch herrings in the English Channel, in the hopes of a profit by sending them to Spain, or into the Straits, when at Yarmouth the first cost of a barrel of herrings is above double the value they cost at Wexford, which can be attested on unquestionable authority."

During the remainder of the seventeenth century, the Irish Fisheries, in consequence of the unsettled state of the country, were greatly neglected; and although those of England and Scotland were encouraged by the Cromwellian Parliament, and still more so after the Restoration, they made no progress.

From 1719 to 1729, it appears, by the custom house returns, the monetary value of Irish fish exported to foreign parts in a few given districts averaged £14,703 2*s.* 11*d.* per annum, which, I think, refers exclusively to pilchards, as that fishery about this time was most productive off the southern coast, and prosecuted with considerable success. Smyth, in his "History of the County Cork," graphically describes its development at this time by French and native fishers. During the American war the impressment of fishermen to supply the Royal Navy was detrimental to successful fishing, as none but infirm aged men were left to work them. In 1780, Anderson remarks, in his "Annals of Commerce," that the herring fishery at Lough Swilly was most productive. The total quantity of herrings bought there in two years, by vessels from Liverpool and the Isle of Man, at the cost of 10*d.* per hundred, was 197,610 mease, besides what were used in the adjacent country, and those exported to foreign parts. These statistics are corroborated by Lord Sheffield, in his work on the "Trade and Commerce of Ireland." "The Irish," says Anderson, "have a great advantage in the herring fishery. The arrival of the herrings, so precarious on the coast of Scotland, is certain on the coast of Ireland; and the fishermen are often enabled to complete their loading in two or three days, and to make several trips during the different seasons. They take a much greater quantity of fish in the same space of time, and also run their cargoes much earlier to market than the British fishermen. Upon the whole, the Irish Fishery may be considered now as but in its infancy. But if nature and the legislature continue to favour it, as they hitherto have done, it must undoubtedly in a few years surmount all rivalship, unless an entire new system of fishing shall be adopted." The same author, alluding to a later period, remarks:—"On the Irish coast the fishermen generally load their boats with a single haul of a net; and each boat cleared £54 in three months of the summer fishing, though the herrings were sold at 10*d.* a thousand, and at times 4*d.* to 6*d.* as many as a horse would carry, though millions were boiled down for oil, and millions were thrown away."

A Special Commission was appointed about this time by the British Parliament to inquire into the state of the British Fisheries, and the best means for their improvement. . This committee continued its inquiries over three successive years. All the evidence elicited, scientifically, theoretically, and practically, was to the effect that the geographical position of Ireland was such that the herrings, in their periodical migrations southwards, arrived at the latitude of Ireland late in December; and in almost every season in these climes they must have encountered much boisterous weather; the great shoals being by that means broken, the detached portion, comprising the principal moiety, continued their route instinctively southwards, and took refuge in the first smooth water, which is usually Lough Swilly. Hence the certainty of a Fishery on the coasts of Ireland, which has never been known to fail.

At this time the Scotch fishermen found the Irish Fisheries so productive and certain, that they preferred them to their own; nay, they forfeited the British bounty, which was more than double the Irish bounty, to fish off the Irish coast, and further submitted to pay an illegal black mail levied on them by the Irish, which was rigorously enforced by the revenue officers, and which they contributed without a murmur of dissent. (See Wakefield's "Statistical and Political Account of Ireland," vol. ii.) A few years subsequently we find a fishery station established at Rutland Island, on the coast of Donegal, by the Hon. Burton Conyngham, which received some support from the Irish Parliament. The entire capital invested was £70,000, and in two months of favourable weather the quantity of fish taken here was sold for £135,000. (See Wakefield's "Political and Statistical Account of Ireland," vol. ii., under head of "Fisheries.")

(Mr. Hoare then described the branding system, from the time of its inauguration by the Dutch, in 1650, down to the present time).

The Irish Parliament were cognizant of the advantage derivable from such a judicious law. In the year 1733 the Act 7 George II., chapter 2, was passed, entitled, "An Act for the further Encouragement of the Fisheries of this Kingdom," which established similar regulations in the Irish Fisheries.

The immediate benefits of this Act may be inferred from the fact, recorded by Lord Sheffield, that during the following year we exported to foreign parts 21,057 barrels of Irish-branded herrings, which realized a higher price than those produced by any other country.

This Act remained in force until 1785, when the great increase of our Fisheries required further supervision; and, according to the 36th section of 25 George III., c. 28, five Inspectors were appointed by the "Lord Lieutenant or Chief Governor or Governors of this Kingdom," to whom power was given "to remove and appoint others in his or their room to superintend and inspect said Fisheries, as they were not competent to execute the increased duties now devolving on them." The branding was continued similar to the regulation of the 7th George II., which was rigorously enforced, and the result was, that Irish herrings were pronounced in foreign markets "superior to all others." The export bounty was paid (this year) on 48,441 barrels, which number represents but a small moiety of the total exported; for, as Dr. Young, F. R. S., remarks, "Although there is a bounty of 2*s.* 4*d.* per barrel on the herrings exported, yet such are the fees and odd duty, that the merchant only receives 11½*d.*; and that is so clogged and perplexed with forms and delays, that not many attempt to claim it."

This law remained in force up to the Union, when it fell into disuse, and consequently the Fisheries became again neglected. In 1819 the bounties were re-established in Ireland, and the branding continued. During this period, we are informed by Mr. Andrews, the number of fishing boats increased from 17 in 1819 to 27,421 in 1823. In 1830, when the bounty was abolished, the Fisheries employed 64,771 fishermen. Six years afterwards we find the number reduced to 54,119.

With respect to the state of the Fisheries at the present time, the official statistics are meagre, limited, and unsatisfactory. In 1855 the Scotch introduced the cotton net, from which time our Fisheries have been improving. This improvement the most casual observer must justly attribute simply to development. On the east coast, the returns show an increase since 1860 of nearly 500 per cent. This favourable result has not arisen from any influx of the natural supply, but from the increased number of vessels, and the superior appliances employed in the Fishery; as to the extent of this development, for many reasons, I do not desire to express my own ideas, but will refer to the returns furnished by the Board of Works. At Howth we have official statistics showing the quantity of herrings sold there last year, from 28th May to 31st of December, 1864, to have realized an aggregate of £94,274 8*s*. 6*d*. This immense sum was produced during 110 days by English, Scotch, Manx, and native boats. Here our official information ends. Throughout the entire of Ireland we only know the product of one station, and from such limited knowledge we are at liberty to deduce whatever inference we please concerning the residue; but this omission at a few places has been supplied by individuals who have taken an interest in the matter. At Arklow, we are informed by a gentleman resident, and connected with the Fishery all his life, that £23,000 has been paid them for fish taken and sold there last year, but of which no mention is made in the Report of the Board of Works. Again, at Ardglass, it appears from a recent communication in the London "Times," that last year £21,450 have been paid there for herrings caught off that part of the county Down; but as this place is not even mentioned in the Report, how are we to know whether this statement is authentic? To my certain knowledge, one firm has paid in two months over £15,100 for herrings caught there this year (1865.)

At Kinsale, on the south coast, the Mackerel Fishery has become most productive. Its development has been prosecuted by Scotch, Manx, and Howth boats, which are superior to those used by the local fishermen. In order to illustrate the advantages the large boats enjoy in this fishery, I will quote the following paragraph from the "Cork Examiner," April 13th, 1865:—

"One small boat belonging to Kinsale received for one night's haul £44. The number of fish in this take was not quite half the maximum of what had been taken in the Manx boats."

This Fishery, during March, April, and May, has been most productive, which must be attributed exclusively to development. I believe £20,000 have been paid at Kinsale for mackerel during the "season," most of which, as at Howth, goes into the pockets of Manx, Scotch, and Englishmen.

The great value of our Fisheries, of which we possess such limited satistics, and in the absence of official information, may be inferred from the yearly increase of English, Scotch, and Manx boats on our coast as the best indication of their value. If it was not because of their extraordinary productiveness, these fishermen would not desert their own vaunted coasts, where their employment is so liberally stimulated by the public purse, governed by the administration of a judicious law, and fostered by the parental supervision of a Board comprising the *elite* of their aristocracy, the enlightened ornaments of their Universities, and the cosmopolitan discretion of their merchant princes. How different is the management of the Fisheries of Ireland! One solitary Inspector has to execute the duties of a public department; that in Scotland requires forty. If any person has business to transact with this department in Ireland requiring personal attendance, he must mount a staircase reminding him of that leading to the whispering gallery of St. Paul's; and, should his breath survive the pilgrimage, he is ushered into a cockloft more resembling the *sanctorum* of an astrologer than the office where the onerous public duties of the Fisheries of Ireland are conducted.

There is another matter that has caused great dissatisfaction amongst that class of hardworking energetic people, of whom I am an humble member. Many gentlemen in this enlightened assembly are probably aware that gigantic efforts have been made, and are being still made, at Howth and Balbriggan, to manufacture herrings for the home market. These efforts, although subject to the greatest opposition, have nevertheless been successful; as some correspondence in the "Irish Times," copied from the Reports of the Scotch Fishery Commissioners, shows that the importation of Scotch herrings since 1852 has decreased nearly 50 per cent. In this instance we have undeniable proof that the development of one Fishery on one part of the coast has been the cause of replacing Irish herrings where Scotch previously reigned *in re absoluto.*

Last year (1864) there were cured at Howth over 5,000 barrels of herrings, as every one acquainted with the trade is aware; but we find no notice of the circumstance in the Report of our Commissioners, although it is recorded in the Scotch Report.

Every measure that can be conceived is adopted to discourage this branch of the business, which is so beneficial in Scotland. Frequent applications have been made for permission to erect either temporary sheds or permanent buildings on the piers of Howth Harbour, to protect the industrious women and children employed in gutting, packing, and cleansing the fish, according to the most approved system. But the Board would not entertain these proposals. On the contrary, they used every means in their power to discourage the immense employment derivable from this branch of the business, and by that means they violated that law which they have been appointed Commissioners to execute.

The 18th section of the 5th and 6th Vic., c. 106, provides that all bodies, corporate or otherwise, are to grant leases for such purposes. The frequent applications, under this Act for permission to build houses for curing, &c., have always been unsuccessful.

With respect to the Pilchard Fishery, off the south of Ireland, which, as we all know, was once celebrated, I will read a communication with which I have been favoured from a gentleman resident at Crookhaven, who is thoroughly acquainted with this subject; he says:—"I have seen as much pilchards this last year about Crookhaven as would load twenty or thirty schooners, if they were taken; but we had no craft or gear to catch them. Miss Burdett Coutts gave two seines to the rector of this parish, to be worked by poor people here, and to give them the fish as charity. They toook a quantity; but, having no means to get casks or salt, the poor fishermen were compelled to sell them fresh, at less than half their value. I never saw larger pilchards. I am confident a fishing company would do as well here, if not better, than in Cornwall, labour being cheaper; and every facility would be given by landed proprietors to erect fish houses, to give their tenants employment," &c. The benevolence and philanthropy of Miss Coutts did not stop there: she has contributed the very liberal sum of £2000 to erect a breakwater or fishery pier at Cape Clear Island, similar to that recommended by the Privy Council in the reign of Edward IV., which will afford protection to the fishermen; and by its means they will be enabled to proceed out to sea, where a superior quality and a greater quantity of fish is to be found to reward their unflagging industry, which is certain to be crowned with success.

With respect to the quantity of fish to be found in the northern and western seas, we are already in possession of facts relating to their productiveness in former years. No circumstance has since arisen to show the possibility of any falling off in that supply. Therefore, the simple question at issue is—Can the Irish fishermen prosecute their vocation with the same success as English, Scotch, Manx, or foreign fishermen? To answer this question without sustaining it by actual proof, would be very little use. Now, let us look to facts. Let us take the Report of the Inspecting Commissioner of Irish Fisheries for 1864, which is the last published by them. In the tabular return furnished by Mr. Barry, authenticated by the Harbour Master at Howth, and Captain Hughes, Coastguard Inspector, to whom we are indebted for much valuable information, and to the endeavours of these gentlemen must be attributed a great portion of the successful fishery that is now established off our immediate coasts. This return of the quantities and prices of fish sold at Howth is one of the most valuable I have ever seen.

The Scotch Board, with its great staff, has never produced any statistics equal to it; and the immense labour, trouble, and anxiety it must have given Mr. Barry is incalculable. In these statistics we find that, during the week ending June 25th, the number of fishing boats at Howth was 16 Cornish, 34 Scotch, 6 Manx, and 69 Irish, when the average receipts per boat were £55 2*s.* 11*d.* During the week ending July 9th, the numbers were 200 Cornish, 80 Scotch, 10 Manx, and 90 Irish; the average price being £1 1*s.* 9¾*d.* per mease; the average receipts per boat being £40 14*s.* 2*d.* During the week ending October 22nd, the number of boats were, 30 Scotch, 70 Manx, and 86 Irish; the average receipts per boat being £61 4*s.* 8*d.*; the average price on this occasion was only 9*s.* 5½*d.* per mease.

In the first instance quoted, we find the proportions were 56 English, Scotch, and Manx, against 69 Irish; and during that week the average receipts per boat were £55 2*s.* 11*d.* In the second instance, when the proportions were, 290 English, Scotch, and Manx, against 90 Irish, the average receipts per boat were £40 14*s.* 2*d.*; while in the third instance the proportions were, Scotch and Manx 100 against 86 Irish; the average receipts per boat were £61 4*s.* 8*d.* Allowing for the difference in the prices realized, we find an increase of 170 per cent. in the produce in *excess* of that period when there had been 200 Cornish boats at Howth, who are alleged to be the best fishermen in the world. Now, in these figures we have proof positive that where the Irish fishermen possess suitable boats and proper appliances, they are able to excel the English, Scotch, and Manx fishermen, as these statistics show. On the west or northern coasts the fishermen are in a most deplorable state, although there is a greater abundance of fish to be found there than on any other part of Ireland. It is a notorious fact, that on that coast the average tonnage of their boats does not exceed *two* tons; and, such being the case, we must not be surprised that their condition is so wretched. There is no reason why these seas should not be as productive now as in former times, when developed by the Dutch, French, Spaniards, and others. Of course, the want of harbour accommodation militates greatly against their development. It has been remarked by Mr. Pim, M. P.,—whose philanthropy during the famine, and whose work then published on the condition of Ireland is to be found everywhere an Irishman exists—that "the harbour accommodation and fishery pier were by no means sufficient for the protection of the fishermen on a coast so much exposed to storms, and open to all the full force of the ocean." During 1846 and 1847, £90,000 were voted to be applied for the erection of piers and harbours; but this fund, like all others in connexion with the Fisheries, since their management was given to the Board of Works, was distributed to suit their "convenience;" and the consequence was, that they only expended £74,700; but what became of the residue we are not informed. The engineering judgment displayed in erecting those piers was really shameful. Mr. Stopford, in a letter to the Commissioners in 1859, remarks:—"We are told that

£90,000 have been given for piers and harbours; I know all that have been built out of that grant, and none are any benefit to the Fisheries. They are all situated for landing sea weed, cattle, &c. In fact, for the benefit of the landlords, not for the fishermen."

Now, let us look at Scotland. The Report of the Commissioners appointed to inquire into the Sea Fisheries of the United Kingdom, recently published, contains a return showing that the moneys spent in the making and maintaining fishery piers and harbours in Scotland since 1829 was £147,242 14*s.* 4*d.** Now, in the face of all the encouragement the Scotch Fisheries received, let us see if they are more productive than the Irish. Let us take the head centre of the Scotch Fishery, Wick, where during 1864 the average number of fishing boats was 976, and the average catch per boat was 92 crans, or 120 mease. The only reliable statistics we possess concerning the Irish Fisheries, as I have before remarked, are at Howth. The returns at Howth show that during 1864 the average number of boats was 169, and the average catch per boat was 1069 mease. These figures are incontrovertible. They give us the reason why the Scotch preferred Dublin Bay in 1640 and 1860 to their own exaggerated Fisheries, notwithstanding all the support they have received from the Imperial Treasury. Sir Robert Peel, in the House of Commons, on the 24th February last, stated that the Dublin Bay Fishery realized £40,000 a month. There can be no doubt that, if the Irish Fisheries were developed to the extent of which they are capable, they would yield an annual revenue of from £5,000,000 to £10,000,000 sterling. "There are but few means of enterprise that present better chances of profit than our Sea Fisheries." Although this quotation from the Report of the Commissioners of the Fisheries of the United Kingdom refers to those of England and Scotland, it may not be out of place for us to see if we can claim any portion of it. At Howth in 1864 there have been £94,274 8*s.* 6*d.* paid for herrings taken off that coast; and if we assume that the portions sold at Arklow, Kingstown, Balbriggan, Skerries, &c., to be half that amount, we find over £140,000 has been taken out of Dublin Bay during six months of that year. Mr. Barry very justly remarks, "that twenty times the number of the present fleet may find profitable employment in our seas, and there is literally no limit to the demand." If we multiply the above return by twenty, that portion of our seas which we formerly considered comparatively speaking to be the most unproductive is capable of producing fish worth £2,800,000 within the period of six or seven months. What may we not expect if the same development was carried out elsewhere, what employment would they not give—how much money their working would circulate!

With respect to the Oyster Fisheries, they are too complicated to discuss on this occasion. One instance of their value I will mention, in order to show what they are capable of. Sometime ago a gentleman purchased, in the Incumbered Estates Court, a tract of land adjoining the sea coast for £100. During the last ten years he has devoted a little attention to an oyster bed thereon, not expending more than £10 or £15 any year since that time. However, he allowed the brood to accumulate, and has recently disposed of his beds, for £24,000, to an English company, exclusively of a lease, the terms of which are not at present definitely settled.

---

* This is exclusive of £11,000 a year annually voted for the maintenance of their "Board."

The Irish Fisheries only require development, judicious management, and a little capital, to become (to use the words of a Scotch magazine) "the Dorado of the country."

II.—*On the Herring Fisheries of Ireland.* By WILLIAM ANDREWS, M. R. I. A., Chairman of the Natural History and Museum Department, Royal Dublin Society; Vice-President of the Royal Geological Society of Ireland, and of the Natural History Society of Dublin, &c.

[Read February 19, 1866.]

THE discussions on the Fisheries at two meetings of the Society, held the last month, presented such differences of opinion with regard to their importance on the coast of Ireland, and their modes of development, especially with reference to the Herring Fishery, that I have been requested to place before the Society the views that I have entertained and confirmed, and which appear to some extent to have been misinterpreted in the limited explanation that was afforded at those meetings.

The paper by Mr. John Hoare gave full statistics of the value that their present mercantile importance has attained, and which the facilities of his business transactions enabled him with some accuracy to put before you.

The present paper will be confined to the Herring Fishery of this country, its great importance, and to observations on the character, seasons, and habits of those fish on the Irish coasts. I shall not enter into the early history of the fisheries, or of the laws that regulated them previous to the Union, but merely refer to that period when their decline became alarming, and which led to the adoption by the Imperial Legislature of more vigorous enactments for their encouragement.

By the Act of 1819 bounties were granted on the produce of the fisheries, and subsequent renewal of Acts greatly stimulated them, until all bounties were finally withdrawn in 1830. Inspectors-General were appointed for each province, and their reports, chiefly those on the fisheries of the coasts of Ireland for the year 1820, plainly indicated how they were controlled.

By the 59th Geo. III., a bounty of £3 per ton was awarded on the tonnage of all vessels fitted out for the deep sea Herring Fishery; and we find by those reports that a brig of 78 tons, and sloops of 67 to 55 tons, were fitted out, and were claimants for such bounty. The Act of 1st of Geo. IV., cap. 82, made alterations with regard to the adaptation of vessels, the gear necessary for them, their equipment, and further prescribed modes of fishing. This encouraged a host of adventurers, who, no doubt, aided by such bounties, were enabled to obtain without loss to their enterprise large stocks of cured fish, which were sold at moderate rates, and which greatly benefited the markets and the population of those places to which such supplies were brought.

In 1824 an abatement on the tonnage bounty for the herring fishery was made; for, instead of £3 per ton, the bounty was reduced to £2 per ton, and £1 per ton was allocated on the cod and ling fishery in the taking and curing. From that date all bounties were gradually reduced, until by the 7th Geo. IV., cap. 47, they ceased on the 5th April, 1830.

It is singular to remark the changes that were effected by those laws on the Irish coasts. In 1819 there were only 27 vessels and 188 men returned as employed in the Irish fisheries. In 1823 there were 27,142 vessels and boats, employing 49,448 men; and from 1824, when the bounties were gradually withdrawn, to 1830 the number of vessels had decreased, while the number of fishermen had increased. In 1829 the number of vessels engaged was 12,611, while the men and boys employed numbered 63,421. The bounties paid a tonnage on all kinds of cured fish, which for the ten years of bounty amounted to £151,390 4*s.* 7½*d.* It is not to be wondered at that those bounties greatly advanced the fisheries of the country; for large and well fitted-out wherries went annually to the west and north-west coasts—from Skerries, Rush and Balbriggan—prosecuting vigorously the deep sea cod and ling fishery, and also purchasing from the fishermen of the coasts large quantities of herrings, which they cured in bulk, the vessels being provided with salt and other necessary stores.

The withdrawal of the bounties greatly affected the fisheries; for the number of large boats rapidly decreased, being principally owned by tradesmen and adventurers, which thus threw a large body of fishermen into distress, and deprived them of employment. Still, however, there were enterprising factors, who annually fitted out vessels for the purchase of herrings around the coasts, especially the winter fish; and the wherries and smacks of Skerries and Rush occasionally made their north-west visits for cod to Boffin, and even to Iceland, and still prosecuted the Herring Fishery, partly by fishing, and by purchasing from the native boats at Killybegs, Galway, and Bantry. It was not surprising that the bounties were withdrawn; for their application had been so frequently misappropriated, and both bounties and loans made applicable to purposes foreign to the objects desired, that their suspension was justly decided on, as removing a very fallacious mode of conferring any permanent benefit.

From this period, each year the Herring Fisheries and the ling and the cod fisheries declined, and succeeded by those sad years of famine and of cholera, almost annihilated our coast population, and forced us to be chiefly dependent upon Scotland for those supplies. Emigration greatly worked out the decline; for although in such harbours as Skerries, the fishermen were numerous, and seamen the best on the coast, and although their wherries and smacks were employed as carriers and traders, yet, that employment not being permanent throughout the year, many annually emigrated to America.

Similarly, in Scotland, under the same act, the 7th Geo. IV., cap. 34, all bounties ceased on 5th April, 1830, the bounties on herrings being gradually withdrawn to that date. For eleven years previous to 1826 the bounty on herrings cured, gutted, was 4*s.* per barrel; and for the four years to 5th of April, 1830, the bounty was reduced to 1*s.* per barrel. That act, however, did not affect the establishment of the Board in Scotland, nor the annual grant made for its support, as the Act of 1808, 48th Geo. III., cap. 110, was made perpetual by a subsequent Act, 55th Geo. III., cap. 94, which constituted the inspecting and branding of fish, and which continued after all other bounties had ceased. By the 5th Geo. IV., cap. 64, a grant of £3000 a year was continued to Scotland in lieu of so much of the grant for tonnage bounties made under the Act of 1808; and that sum is drawn to the present day by Scotland.

This Act (5th Geo. IV.) also confirmed the Act of 59th Geo. III., cap. 109, which allocated to Ireland £5000 per annum, Irish, for similar purposes; and these grants to both countries continued after all bounties had ceased, and do still continue in full force.

On the nature of the grant to Ireland I shall hereafter make some comments. It is reasonable to inquire what caused the rapid decline of the Irish fisheries after the cessation of bounties; while Scotland, on the other hand, seemed each year advancing, and increasing in the number of boats and men engaged in the fisheries, not only supplying its own immediate wants, but largely exporting to Continental markets, as well as to Ireland. By some authorities the capriciousness of the herring on our coasts is said to have been the main attributable cause; by others, the indolence and want of industry of our fishermen; and many have averred that the fisheries on the coasts of Ireland are so fickle and uncertain as to have led to the utter failure of all attempts at their development. Not any of those surmises—for they are but surmises—bear the slightest foundation of truth. What, may I ask, has for the last half century brought annually the boats of Penzance and of St. Ives to visit Ardglass, Howth, and Kingstown, and to remain until the pilchard fishery of their own shores caused their return—what the Campbeltown and the Manx boats, were it not that remuneration each year compensated their summer ventures to the Irish coast? No; their success was consequent on the superior equipment of their boats; their long and deep trains of nets, of superior make and fineness; and, above all, their superior judgment and experience in seeking the early summer fish in the deep water, and detecting the influences of winds and of currents that affect the changes of the course of the fish during the several seasons. To these may be added the facilities of a ready market for the fresh fish. It was owing to the want of these means that even in 1861 there were but four boats fitted out at Howth for the fishery, which caused the stranger fleet to be attended by a number of carrier smacks. Although Arklow men were by no means incapable of coping in industry and perseverance, and though much improved in nets, their boats were not of sufficient tonnage; and thus the Skerries, the Rush, and the Balbriggan boats, once so famous on the north-west coasts as deep-sea line fishers, had chiefly become buyers of fish, as well as carriers of potatoes and of manure.

For some time after the bounties ceased, the Skerries boats still continued to visit the coast of Donegal, generally being at Killybegs about Christmas to purchase the winter herrings. These boats averaged 45 tons, stowed each about 14 tons of salt, and carried a boat on deck for shooting nets; and the quantity of fish taken may be estimated, when, with but indifferent nets, and the native boats from which they purchased fish being but three tons, with only four oars, a wherry was enabled to complete a cargo of 200,000 herrings, cured in bulk, for sale in different markets. These enterprises at last altogether ceased; and, when the coasts were almost depopulated of fishermen, the boats and the nets wretched and inferior, and wholly unsuited to the deep water, then it was said that the Irish fisheries had declined, and were unproductive. Still there are many of the smacks employed as carriers, and buying fish from the fishermen for the home markets.

Brighter scenes, however, have now chased away those erroneous views; and the men of Howth, Skerries, Balbriggan, and Arklow can vie with the ablest of the Cornish and Scottish craft. By assistance given to many of the fishermen, it has been shown that the fishermen of the east coast can compete in seamanship and industry with the best of their annual visitants. Along a great part of the east coast fine boats are now fitting out for the Herring Fishery; Howth, Skerries, and Balbriggan taking the lead in the superiority of vessels. At Skerries alone there are 116 smacks and luggers; 42 luggers, averaging 30 tons each, fitting out, with full complement of herring nets, where but a few years since not a single craft was so engaged. For the coming season fine luggers, both at Howth and at Balbriggan, are preparing for the mackerel season off the south coast, and the same may be said of Kinsale.

Great assistance has been given by loans through the Society for Bettering the Condition of the Poor of Ireland; for the Society has ad vanced to the extent of £3000 in the year, free of interest, and repayable by easy instalments. An intelligent and enterprising man at Balbriggan assured me that he had made thirty per cent. on the loan he had obtained.

The capriciousness of the Herring Fishery has often been urged by those who are ignorant of the true habits of the fish, as decidedly unfavourable to the investment of capital in such a branch of industry.

Some writers still maintain a migratory disposition of the herring; and state that bays and estuaries, which they once frequented in abundance, are now completely deserted. The Cornishmen have often remarked that there does not appear any diminution of the fish off the coast, but that frequently a good night is succeeded by an unsuccessful one, and then the herrings appear plentiful again. This is all attributable, as I have before said, to the good or the bad position of the boats, when weather or other causes have influenced the great body of the fish to change the direction of their course, and which is constantly varying in the deep water, until the maturity of spawning forces their closer approach to the shore. The herring is a deep-water species, remaining throughout the year off the coasts of its birth; hence it is that, in the Clupeadæ, as well as in other genera of our marine fish, locality, soundings, and distribution on our coasts, more or less affect superiority of quality of the same species. The herring is abundant around the entire coasts of Ireland. The small and unsuitable boats, and the limited length and depth of nets, prevent the herring being sought at those parts of the Bays of Donegal, Galway, Dingle, Kenmare, and Bantry, where the fish in the early part of the season are to be met in abundance, and of a quality not inferior to first-class fish of the Scottish lochs. It is superiority of tonnage and equipment that occasionally gives such enormous returns to the Yarmouth, Sussex, and east coast boats that fish far from the land, and that supply the English markets with the earliest and primest fish; and even the Cornish boats that visit our coast in the summer are during the spring months employed in mackerel fishing, from S.S.W. of the Lizard to within a few leagues of the French shore. Our men of Howth and other parts of the east coast are now adding both to the tonnage and equipment of their boats, and each year with greater profit in their pursuits; for they now successfully, in the mackerel season, brave the heavy weather off the south coast. I have frequently, in early summer, off the Shannon, and off Dingle and Tralee Bays, seen the herring in extensive shoals, when not a fish had entered those estuaries. In the month of June, off the Arran Islands, Galway Bay, I passed through such masses of mackerel and herring of a fine night, that handnets full could have been lifted into the hooker, and yet no fish were captured by the Claddagh boats until the latter part of the summer, when the fish moved up the bay within Blackhead.

To accomplish great success, ample means must be employed; and with a knowledge of the coasts, and of the habits and seasons of fish, capital so employed is as sure of return as any other mercantile speculation. During a month of last season the Yarmouth fishing boats alone caught 25,000,000 herrings, valued at £30,000. The value of a seine in the pilchard fishery, with boats and grapnels, is said to be £15,000. Seven seines, joined, took, on the Cornish coast, in one haul, pilchards to the extent of £25,000, which were cured for the Mediterranean. During 1865, St. Ives sent to Mediterranean ports pilchards which realized £23,647 10*s*. Forty-eight thousand barrels of fresh herrings of 700 each, 265,000 baskets of bloaters, of 150 per basket, and 60,000,000 of red herrings, are annually consumed in London.

The quality of the Irish herring has often been commented on, and by many of experience stated as superior to fish of the best condition of the Scottish coasts. There can be no doubt of the truth of this, but not in the present state of the Irish fisheries. The quality of the herring depends upon the season and mode of capture, and upon the superior system of its cure. It is that that has rendered the Loch Fyne herring of such standard quality—its early capture in the primest season. Since the last meeting of the Society some Loch Fyne herrings were sent to me, which for delicacy of flavour and quality could scarcely be equalled; the roe and the milt were but partially developed. I was informed that many of the lochs north of Loch Fyne had herrings fully equal in quality, such as Loch Eribol, and that they are often sold in Glasgow as Loch Fyne, and the very best judges cannot detect the difference. Such would be the case with the Arklow and Howth herrings, if carefully handled when taken from the nets, and a proper system of cure attended to. On other parts of the coast of Ireland, where herrings are abundant and of fine quality, their superiority is altogether lost by the modes of capture, and lateness of the season when taken.

I come to an important part of the life of the herring—the periods and the habits of spawning. Few are the writers on ichthyology that have given proper attention, or indeed had the opportunity of tracing the career of the herring throughout the seasons. Even John Mitchell, of Leith, who in 1864 published voluminous statistics of the herring, had not correct knowledge of its true habits. I had intended criticizing the remarks he had made on the Fisheries of Ireland, but *mortuo verba nunc facio.*

It has long been known to practical fishermen on the coasts of Ireland that there are two seasons of the herring in the year—the summer or harvest herring, and the winter herring. In many bays on the western coasts, such as Donegal, Galway, and Bantry, the winter fishing was a great profit to the native fishermen, as boats from the eastern coast frequented those bays to purchase, and to cure in bulk for different markets. This trade has nearly ceased, owing to the wretched condition of the coast fishermen, and their want of boats and nets capable of supplying to purchasers the quantity required. Herrings can be taken on the coast at all seasons of the year, but their condition varies much with the several seasons. In May the summer herrings begin to move from the deep water; in June they appear in large and compact shoals; in July and August they approach nearer the land in great bodies; and in September and October perfect and complete their spawning conditions. During the month of October fine fish may be taken, but still they are mixed with spent or shotten fish. During November, although quantities may still be taken, yet they are spent and insipid fish, generally mixed with numbers of fish of an inferior size that have not spawned. In December they have mostly returned to deep water. The winter herring fishing begins early in January, and terminates the middle of February, when those fish begin to spawn, and continue so during the month of March. From the middle of February to the middle of April the herring is unhealthy and insipid. Such are the seasons of the summer and winter fish. The summer herrings are richer, and more delicate in quality; the winter fish, superior in size, but coarser. The fish that have not spawned during the autumn are those at that time of inferior size; but, rapidly increasing in development, spawn in the spring.

Some years since, in the month of September, when on a visit at the hospitable Castle of Derryquin, in the harbour of Sneem, Kenmare Bay, large quantities of herrings were taken. The harbours of Sneem, Kilmachalogue, and Ardgroom, were alive with fish. Several fine nights I visited the little herring fleet, which, inside the harbour, with their shallow nets, were taking the fish in abundance. The fish were fine, and in full maturity of spawning. During a south-west breeze the fish were seen rushing in bodies in every part of the harbour, and so numerously, that from the rocky ledges and at the shores they were taken by handnets and baskets. I carefully watched their movements, and found it was the full excitement of spawning. The fish were densely pressing upon each other in every part of the harbour. Those that were taken had ejected both ova and milt, which agglutinized together, and, being of heavier specific gravity than the water, sank to the bottom, and became attached to stones, seaweed, or to any substance met in descent. Thus, in every part of our coast, in the shoaler bays or inlets, the instinct of the herring at the full maturity of spawning incites its approach to deposit its spawn. In the month of October, the "Galway Express" mentions that near 400,000 fish were brought into market in one day, all captured about the pier, and far up in the inlet of Oranmore.

It is mentioned that, in a little bay east of Cromarty, such an immense shoal was thrown, or rather ran themselves ashore, that salt and casks failed the packers. Similar is the instinct that excites the capelin (*Mallotus arcticus*). These little fish crowd into the shores of Newfoundland and Labrador in July, in countless myriads, to spawn. In the bays every rolling wave strews the shore with hundreds of capelin, which are washed off by the retiring wave, all leaping and pressing together in the act of depositing spawn, the compression excluding the ova. The ova become attached among fuci and confervæ.

From the views I have given of the spawning seasons of the herring, it is clear that, should a close season be essential, that prohibition should be exercised for November and December, and from the middle of February to the middle of April. At those periods the fish are soft, insipid, and not suitable for curing.

Having so far endeavoured to condense a subject so extensive as the state of the fisheries and the habits of the herring, I now turn to its mercantile importance. Within these few years the capture of the herring has been so successful to the boats of our fishermen of the east coast of Ireland, that the branding system has been agitated, and regarded by many as essentially necessary to still further promote the industry of the country, and to secure to it some portion of the benefit that Scotland is considered so largely to derive from it. The brand is the relic of the old bounty system, granted and continued to Scotland in lieu of tonnage bounties, and in connexion with other grants that are still in force in that country. Although, under the inspection directed by the Board of Fisheries of Scotland, a notice of all fish cured must be given to the inspecting officer, yet it is not compulsory on the curers to have the brand. The returns, therefore, show that nearly the whole of the western parts of Scotland reject the brand, the use of which appears only general to the eastern parts of the coast, and to Stornoway, Shetland, and the Orkney Isles. The Continental agents or merchants at the ports, to whom are consigned the large exports from Scotland, feel confidence in the official brand, when marked as Crown full, Crown P., Crown PP., or as Maties; and which, without examination, facilitated their disposal in the inland markets. Deceptions have been consequent, and many consider it far better to abolish the brand altogether, and to depend upon the reputation of the curer, whose trademark would be ample security for the purity and value of his consignment. Is not the XX of Guinness, the LL of Kinahan, and the name of Jameson, such as to secure the reputation of their exports to all countries? If we confined ourselves to such examples, no doubt the reputation and quality of the Irish fish would eventually be justly esteemed wherever exported to. Still, so long as the brand is of utility to Scotland, it is but just that she should continue to maintain that right, and those grants that have been drawn by her for years for the encouragement and the protection of her fisheries.

But, on the other hand, Ireland should also receive her share. No brand favours the industry of Irish produce, and she has even been denied for years that grant of £5000, which she annually should have received under the very same Act of Parliament under which £3000 a year to this day has been drawn by Scotland.*

---

* Referring to the Report from the Select Committee on the Taxation of Ireland, ordered by the House of Commons to be printed 1st June, 1865, at page xxxix will be found the amendment proposed by Sir Edward Grogan, which fully details the several Acts of Parliament bearing upon this important question. The whole of the fishery laws *with regard to bounties*, and the duties of the Commissioners appointed under the Act of 1819, ceased by the Act of 7th Geo. IV., c. 47, on the 5th April, 1830; the Act of 7th Geo. IV., c. 34, sec. 4, merely superseded those portions of the Acts 59th Geo. III., cap. 109, 1st Geo. IV., c. 82, 1st Geo. IV., c. 108, which related to bounties, and which were to be discontinued on the 5th of April, 1830. The Act 1st William IV., c. 54, sec. 8, has been viewed as repealing Act 59th Geo. III., c. 109, but which seems to have been misinterpreted with reference to that section which quotes the annual grant of £5000. The Commissioners of Fisheries appointed under the Act of 1819 terminated their duties when the bounties ceased, and it was necessary that the construction of piers and harbours, undertaken by said Commissioners previous to 5th April, 1830, should be completed. Grants to the extent of £18,000 were sanctioned by the above Act to the Directors of Inland Navigation for that purpose. These grants did not affect the discontinuance of that £5000 a year, which, under sections 9 and 10 of 5th Geo. IV., c. 64, still continued in force in Ireland; and which the Act of 5th and 6th Victoria, c. 106, sec. 1, fully confirmed.

It may be argued, what has Ireland to do with a brand? Look at the present imports, between 70,000 and 80,000 barrels of herrings required by her from Scotland each year, chiefly from Wick, Stornoway, and the Orkney Isles, and to these may be added supplies from Norway. Large imports also are made of ling and cod, and Newfoundland fish. Yet even these supplies were short of the demand during the Lent of last year. Are not, then, these strong grounds to seek those rights for the encouragement of our fisheries, and to induce capital to be expended in the obtaining and securing to ourselves those stores that are inexhaustible on our coasts? It is seen that the takes of fish both at Ardglass and at Arklow, in the early part of last summer, were great; and that the continuation of the takes was large that were throughout the summer brought to Howth. The demand for the English market, and for fresh fish, left but little surplus; for it was only when the late day sales, or the price per mease was lowered, that limited purchases were attainable by the home curers. Had Scotland the same facilities for the transit of her fresh fish that we possess, the curing for foreign markets would be greatly limited. Two-thirds of the fish barrelled and sent from Loch Fyne are but slightly salted, and are sold as fresh in the home markets. The facilities of transit in Ireland are now great, while the resources all around our coast are almost untouched. We require capital; we require large boats, and these prudently managed and disposed with judgment; and with a knowledge of the seasons of fish, and of the habits of the fishermen, no mercantile speculation would be more remunerative. The cattle plague has struck terror into the British Isles; a scarcity of provisions is threatened, and yet upon what resources could we so securely depend as upon our fisheries? See the returns for the investment of capital. Scotch barrelled herrings at present realize 40*s.* per barrel, ling 34*s.* to 36*s.* per cwt., or 4½*d.* per lb., and all other fish scarce and high in proportion. But we want large boats; and this will lead to another object of great importance, and one strongly demanding the attention of the Imperial Legislature—viz., the harbours of our coasts.

To the kindness of my esteemed friend, Charles Haliday, Esq., of Monkstown Park, I am indebted for references to his extensive and valuable collection of records and reports of the past and present history of the state and condition of this country; and he kindly placed at my disposal a collection of charts of the entire surveys of the Irish coasts, as well as all records and Acts of Parliament bearing upon the subject that I have been so much interested in. The original plans of the piers and harbours designed by the late Alexander Nimmo, C. E., and the surveys and soundings made in 1821 and 1822, under the directions of the Commissioners of Fisheries, as well as charts of the harbours of the east coast, dated more than one hundred years since, I have carefully examined. These, however, give no useful views beyond the test of the soundings of those dates and recent surveys; but they convey very satisfactory evidence of the alteration of depths of soundings by silting or other causes. Nimmo's piers were but indifferently constructed; and, being mostly tidal, were only suited to the small hookers, yawls, and corrachs then in use on the coasts. The few hundred pounds allocated for their formation did not afford proper durability in their structure. The winter storms have mostly cleared the work.

Along our eastern coast, where our fisheries have most progressed, our harbours are tidal, and inadequate to contain the boats that assemble for the fishing. From Kingstown south to Wexford, or north to Ardglass, where have the boats to run in heavy weather? The best position I see on that coast is that of Skerries. The fishing grounds lie chiefly to the north-east of the Rockabill; and even Ardglass, that has some depth of water, is not so convenient as a general position as Skerries. But Skerries is a tidal harbour. The large class of boats now belonging to Skerries, to Rush, and Balbriggan, have no place of refuge in a breeze of wind, nor to work out to the fishing grounds at all times in suitable weather. They must lie hauled up for the winter, or sheltered in the creek of Baldoyle.

The pier of Skerries runs in a northern direction 650 feet, having a depth of water at its extremity of fifteen feet at high tides. The springs, full and change, rise fourteen feet, but the harbour within dries at low water. By an old chart, 1765, no silting appears to have affected the soundings. Parts of the harbour appear greatly changed, and the anchorage much injured by ballast being discharged by the Wicklow boats that go there for limestone. It is stated that occasionally 150 tons a week have been so discharged during the last twenty years, and even in reports of 1835 the evil of this practice is particularly alluded to. The clearing of that harbour should be enforced, and the present injurious custom checked.

I have alluded to a grant of £5000 a year, Irish currency, and which is still in force, and mainly applicable to harbours and fishery piers. This sum has been unappropriated for the last thirty-five years. Skerries is a position for the allocation of such moneys; and were the soundings cleared in the harbour, and a breakwater pier extended along the rocks of the cross which project seaward 750 yards, having a wide basement and firm foundation, and by giving a slight elbow or curve at the extremity, deep water would at all times of tide be inside, and would afford ample shelter for all classes of vessels that frequent that part of the coast. In the furtherance of such plans the Commissioners of Fisheries, in the Report for 1821, refer to the importance of the aid, through the Royal Dublin Society, by a statistical survey of the coasts. It would be the means of greatly encouraging the building of a large class of boats, and of giving employment in the fisheries throughout the winter to the men of Skerries, Balbriggan, and of Rush, and thus retaining a fine body of fishermen and seamen in the country that otherwise are forced to leave their homes, and which also tend to their directing attention to other pursuits than the sea.

The Scotch Board of Fisheries has been for years sensible of the importance of improving the fishery harbours and piers. In addition to Government grants, large outlays have been made by the British

Fisheries Society for the improvement of the harbours on the east coast of Caithness; and now that society has promoted the formation of a splendid harbour on that coast, to the extent of an expenditure of £120,000. Such attention should seriously be directed to our shores; for, until we have safe positions for our large boats, our fisheries will still remain much crippled. The advantages from the accomplishment of such improvements will be great—the retaining on our coasts, and the employment throughout the year, of a fine body of seamen, and the training with a certainty of a livelihood at their own homes the sons of the fishermen. See the benefit that may accrue to our merchant marine, that at present are forced to man their ships to a great extent with foreign seamen—the sad and melancholy results of which are too often detailed.

The utility of training ships would be thus desirable in certain positions of our coasts, which would stimulate and promote a desire for the sea, and those vessels would be essentially serviceable in maintaining an orderly state among the fishermen in their pursuits. The violent aggressions of the Claddaghmen have often been recorded, not only exercised by them against strangers, but against their neighbours of the bay who they considered infringed their rules. They exacted all monopoly, and regulated the markets, preventing an excess of supply through the exertions of the more industrious fishermen. The Report of the Commissioners of Fisheries for 1820 mentions the necessity of "The Plumper" Gun-brig being sent there, which so awed those lawmakers that the supplies of fish exceeded all expectation. Three hundred boats daily lined the quays, each containing 10,000 to 20,000 herrings. Vessels were laden for other markets, and all the inland parts were most abundantly supplied with the cheapest food. At that period herrings were cured in bulk to an extent of 4000 barrels, of 700 fish to the barrel, while now nearly that quantity of Scotch barrelled herrings are annually imported by Galway.

In conclusion, I cannot avoid commenting upon the views recommended in the Report of the Commissioners appointed to inquire into the Sea Fisheries of the United Kingdom. In the limited opportunity afforded them of the examination of the state of the fisheries of this country, they certainly appear to have advocated an extent of freedom and removal of restrictions by no means calculated to improve their condition. Legislative control and restriction are absolutely a necessity as regards this country. Although I have supported the utility in every sense of deep-sea trawling, yet I have always maintained that, within certain limits of soundings, a prohibition should be observed against all classes of trawl boats, and injurious shore netting, that have always proved destructive to the fry of all kinds of fish. The Acts of 5th and 6th Vict., cap. 106, and 11th and 12th, cap. 92, placed the control of the fisheries in a public board, and gave to it powers with regard to the regulating of our sea fisheries, which, if maintained in all the integrity of their principles, must of a certainty be productive of advantage and protection. Still, I must agree with the Commissioners, who observe in the Report that the Acts "might, in the hands of injudicious and meddling administrators, become sources of much injury to the fisheries, and of the most vexatious interference with fishermen,"

I trust that our Irish Members of Parliament will band together, and maintain to us our rights and our laws, so essentially necessary, and by which alone we can hope to foster, to advance, and to protect our fisheries,

I will finish in the words of the eloquent Right Hon. Frederick Shaw, expressed at a dinner given by my esteemed friend the late John D'Arcy, when Lord Mayor of Dublin—"I cannot believe that Ireland, for whom God and nature have done so much, and man so little, with all her great capabilities, and her yet undeveloped resources, is not to have her day. We must all feel and deplore that we have already had a long, dark, and dreary night; but I trust that we discern streaks of a more promising morn—that Ireland will cease to be a byeword among nations, and that she will become an honoured, and, as I believe she ever must be, an integral portion of the United Kingdom."

Mr. Barrington, T. C., ex-Lord Mayor, referred in a complimentary manner to the ability with which the subject was treated by Mr. Andrews, and said he would add nothing more to what had been stated than to draw attention to the young company for the promotion of fishing interests in Ireland. He also referred to the fact that the £5,000 a year formerly granted by the Government for the improvement of Irish fisheries, and which of late years had been discontinued, would now, if paid up, amount to £200,000, with compound interest. He thought the Government should be called upon to pay it up, if there was any chance of their doing so.

Mr. James Haughton, J. P., thought that the first thing the Government ought to do would be to provide proper harbours for shipping; and, having gone so far, they should endeavour to establish the most perfect system of free trade in every branch of business.

Mr. Roper (Barrister) spoke on the importance of asking from the Government money for the purpose of developing the resources of the fisheries of the coasts of Ireland, particularly as he thought it was a favourable time for asking with a chance of being listened to. If some of the statistics, such as Mr. Andrews had furnished, were given to some of the Irish representatives, the screw might be put on the Governors at the other side of the Channel with benefit to Ireland.

Mr. Walsh (Agent for Lloyd's) said, that the Society should feel indebted to Mr. Andrews for the very valuable and interesting paper just read on the subject of our fisheries; so clearly pointing out the difficulties under which the poor fisherman labours, and the reasons why our truly valuable fishing grounds have not been more fully developed, although they offer such a field for profitable investment. Mr. Andrews has entered so much in detail into the subject, and has so ably described the causes of this backwardness of the fishery interests, that he has left little for others to say beyond reiterating what he has already so clearly laid before you. An acquaintance of many years' standing with the several fishing towns and villages along the east coast, from Balbriggan to Courtown, enables me to bear testimony to the accuracy of Mr. Andrews' view, that one cause of this backwardness is the inability of the fishermen to provide suitable fishing tackle and boats at the proper season. In this, however, I am glad to say, I have recently observed a decided improvement, which I trust may continue. But of another cause, alluded to by Mr. Andrews, I cannot speak so hopefully; I allude to the want of good piers and safe harbours near their dwellings, to which the fishermen might bring their boats. I cannot point to a single pier or harbour on the east coast which meets the requirements of the fishing interests. Balbriggan harbour is not available, but at high water, or near it. Skerries harbour, where the natural advantages are great, presenting striking facilities, not only for a fishing harbour, but even for a Channel safety harbour, has been sadly neglected, and permitted to go to decay; the boats frequenting it to load limestone having been permitted to throw their ballast overboard, even inside the harbour. Howth, after the enormous outlay therein, has been allowed to silt up to such an extent, that the authorities have been obliged to send a dredging machine to clear out the entrance, and remove some of the accumulated silt which fills the harbour; and at Arklow, where the Hibernian Mining Company have spent large sums in raising piers both on the north and south side of the Avoca River, I fear the work has not proved of advantage to the fishermen—since, when obliged through stress of weather to run from their fishing ground for shelter, they find the entrance to the river a source of doubtful advantage; many boats sustaining much damage, and some being even wrecked in attempting to get over the bar. Mr. Andrews drew attention to an Act authorizing an annual grant for fishery purposes, and remarked that, though this Act is still in existence, the grant has not been paid for years; this, if devoted to its legitimate purposes, would enable great benefits to be conferred on the fishermen, and do away with or mitigate many of the drawbacks and disadvantages under which they at present labour.

Mr. HOARE referred at considerable length to statistics on the subject.

Professor SHAW referred to the state of the fisheries of the Isle of Man, and the thriving state in which they were in consequence of their harbour being well looked after by the Government. The filling up of our harbours was the only reason he could see amongst those advanced for the backward state of the fishery trade, and he thought a pressure should be put on the Government to improve and build Irish harbours and fishing piers.

Mr. MATTHEW M'GOWAN, of Skerries (Master Mariner), said that he thoroughly agreed with Mr. Andrews in all his views and remarks on the fisheries around the coast of Ireland. He spoke from an experience of seventeen years, having fished off all the principal grounds of the north-west and west coasts, especially off Innisboffin; also off the south coast, and along the entire east coast; he had likewise been with his vessel to Iceland. He fully agreed with Mr. Andrews in the remarks he has made with regard to our harbours and their present state. A proper investigation of their present condition, and of their insecurity and unsuitability to large class fishing boats, is absolutely essential to a proper promotion of the fisheries. Skerries, in particular, is almost useless, from the shoaling of the best parts of the harbour, from the large quantities of ballast that have for years past been discharged there, not unfrequently, as Mr. Andrews has observed, 150 tons in the week. The large assemblage of English, Scotch, and Manx fishing boats that annually frequent Skerries would be greatly benefited by an extension of the harbour, as proposed by Mr. Andrews, not to speak of the large and increasing numbers of Irish boats that are throughout the year there. Besides, the localities of the fishing grounds are such, that great loss of time occurs in working to and from Howth with contrary winds. The improvement to Skerries, suggested by Mr. Andrews, would with strong easterly gales afford great shelter to all classes of vessels, as much damage in such weather too frequently happens along the east coast. At the Isle of Man, at St. Ives, at Wick, and at other fishing stations on the British coasts, good safety harbours have been formed; and, although petitions have been signed in favour of Skerries by English and Scotch fishermen, by those from Cumberland, Whitehaven, and Maryport, and also by the Drogheda Commissioners, there is no Member of Parliament to advocate our cause, nor Fishery Commissioners to report to Government in our behalf as in Scotland, when we have had 500 sail in our road in the fishing season. Much more could be represented, but Mr. Andrews has fully advanced all that could be said on the subject.

The CHAIRMAN (Sir E. Grogan, Bart.) thought that this evening's meeting would be productive of good results. During the last two years—the last session and session before—there had been a very important committee appointed to consider the taxation of Ireland, and that committee dwelt very largely on the point that Ireland had a right to some share in the national expenditure. The result was some expenditure towards the establishment of a dockyard in the Cove of Cork. There were five dockyards in England, and it is needless to dwell upon the advantages in the way of employment, and in the training of mechanics and skilled labourers, resulting from these establishments; and he did not see why, if they contributed a full share to the national exchequer, they should not have a proportionate share of expenditure in return. The subject of Mr. Andrews' paper was of the utmost importance to Ireland. Around our coasts there was an abundance of all kinds of fish, and plenty of willing hands to catch them; but some assistance on the part of the Government was necessary, to enable our people to take advantage of the almost inexhaustible supplies of good and wholesome food placed, as I may say, by Providence at our very doors. What we wanted were suitable fishery harbours for the shelter and protection of the fishermen and their boats; without such harbours they could not have boats, and without boats no fish could be captured. The first and most important point, therefore, was the erection of fishery harbours in suitable localities around our coasts, and the improvement of such as may have been heretofore erected; and he did not see any more advantageous manner in which public money could be expended in Ireland than in the erection and improvement of such harbours, whereby immediate and remunerative employment would be provided for a large and deserving class of our population, and an abundant supply of food obtained for all classes—a consideration of no small importance at this moment. In asking for this assistance from the Government, they did not come forward as simple beggars to make an "ad misericordiam" appeal to the Parliament and Government of the United Kingdom, but they came forward to ask as *of right* that the same advantages, the same encouragement, which had been for so many years extended to Scotland in the development and improvement of her fisheries, should be given to us; especially as the right of both countries to grants for fishery piers, and the encouragement of the fisheries, was specially reserved and continued to each of them by the Act of 1842. He (the Chairman) had had several interviews with Mr. Andrews on this subject; and Mr. Andrews had convinced him that Ireland was still fully entitled to the grant of £5000 a year for the erection of fishery piers and the encouragement of her fisheries, originally provided under the Act of 1819, but which of late years had been allowed to fall into abeyance. The right of Ireland to this grant was clearly reserved and continued by the Act of 1842. Previously to this Act, there had been various Acts passed at different times, regulating and varying the bounties to be given for the encouragement of our fisheries; these Acts expired in 1830, and by an order of the Government of that day all the accounts connected with them (and they were both intricate and complicated) were to be closed, and all further payments under them discontinued. This order only applied, and could only apply, to the bounties I have alluded to; for, however high an opinion we may be disposed to entertain of the prerogatives of the Crown, no order of the Crown, or of the Lord Lieutenant, can in these kingdoms repeal an Act of Parliament; the grant of £5000 a year under the Act of 1819 is therefore, in my opinion, still available for the purposes for which it was originally intended; and this opinion is, as I am informed, shared by gentlemen of high legal standing in this country. However, the authorities of the day, who were intrusted with the management of our fisheries, took a different view; the grant was allowed to fall into abeyance; and an arrear, amounting to upwards of £144,000, is now due to Ireland on account of this grant. If any confirmation of the correctness of the opinion I have ventured to express on this subject were required, it will be found in the Act of 1842, whereby all the Acts relating to our fisheries were by name (including that of 1819) repealed—an enactment which would have been useless and unmeaning, if the interpretation put upon these Acts by the Fishery Commissioners in 1830 had been valid and conclusive. We have a right, therefore, in my opinion, to have this arrear applied to the erection and improvement of fishery piers around our coasts; and it is needless to point out the great benefits which the expenditure of this sum for these purposes is calculated to confer upon our maritime population. A considerable expenditure for these purposes is required, and is absolutely necessary; this arrear would go a long way; and any additional sum which may be wanted would be amply repaid in the development of the almost untouched mines of wealth surrounding our coasts, and in the peace and prosperity of our fishery population, for whose benefit so little has of late years been done. We have a market in Liverpool, and the other centres of population in England, for any amount of fish our people may take. The expenditure of the money to which I have alluded is sure, therefore, to be remunerative, while the greatest benefits to both countries will also flow from it. One of the recommendations of the Parliamentary Committee of last year was, that the opinion of the law officers of the Crown as to the repeal of this grant of £5000 a year under the Act of 1819 to Ireland should be taken; and I can have no doubt that General Dunne—whose zeal and determination in pressing the interests of his country are well known, and to whom we are indebted for the appointment of the Committee—will not lose sight of this point, but will crown his labours by urging the Treasury to consult the Attorney and Solicitor-General as to Ireland's continuing right to this grant, whereby such incalculable benefits would be conferred upon a large class of our population. The right of the people of Scotland to the grant of £3000 a year for the encouragement of their fisheries is preserved and continued to them under the Act of 1842, and this grant they enjoy up to the present time; it has, however, been largely increased, and the sums paid by the Treasury in aid of the fisheries of Scotland amount to £14,000 or £15,000 a year; while the £5000 a year continued to us by the same Act has, as I have already stated, been allowed to fall into abeyance; and nothing, or comparatively nothing, is paid towards the encouragement of our fisheries. Mr. Andrews has pointed out the extraordinary increase and development of our fisheries under the system of bounties which formerly existed, and the great collapse which ensued when the bounties were withdrawn. But, while we cannot look to any renewal of that system, it is highly satisfactory to know that our fisheries are again progressing; and with the assistance (small in itself as it may appear) which the Trustees for bettering the condition of the people of Ireland are enabled to give, are again rapidly improving, and this without any loss to the Trustees. He has informed us that the loans made by the Trustees to the fishermen to enable them to obtain better boats and fishing gear have been thankfully and faithfully repaid; that an improvement in the number and size of the boats, and of the necessary nets, &c., for prosecuting the fisheries, more than commensurate with the extent of the loans, is observable; while the improvement in the condition and habits of many of the people engaged in the fisheries is also observable, and every well-wisher of Ireland must hope it will be permanent; but, to insure the permanence of that improvement, something should be done immediately by Government for the protection of the lives and properties of our fishing population, by the erection and improvement of fishery piers and harbours in suitable localities around our coasts. He concluded by thanking Mr. Andrews for having brought this very important subject so ably and so clearly before the meeting.

III.—*On Submarine Earthquakes and Volcanoes.* By Dr. J. M. Barry, L.K. & Q.C.P., L.R.C.S.I., M.R.D.S., M.R.Z.S., &c., &c.

[Read April 16, 1866.]

During the month of November, 1865, I experienced in the South Pacific Ocean some of the phenomena attending submarine volcanic action. This circumstance, together with subsequent opportunities of collecting information on the subject of marine earthquakes, has suggested my bringing this paper before the Society this evening.

I have succeeded in discovering the records (which I have every reason to believe authentic) of more than thirty instances of volcanic disturbance in the Atlantic Ocean, between the years 1740 and 1860. A short abstract of some of the most important I beg leave in the first instance to draw your attention to.

There is a space on either side of the Equator, between 7° N. and 3° S. Latitude, and 16° to 29° of West Longitude—an area measuring some 600 by 800 miles—which may be deemed one of the great submarine centres of volcanic action; within the limits of this space *smoke, steam*, and ashes have been seen to issue; vessels traversing it have experienced shocks, more or less violent, and in some instances have struck on unknown rocks, subsequently not to be found.

In the year 1813 the ship "Warley" passed over a shoal in Lat. 5° 4′ N., and Long. 24° 25′ W. In the year 1796 a French authority reported a shoal in 4° N. 19° W. Not very far from the same locality the ship "Mary" reported having seen a reef on which the sea broke. I have grouped these three reports of obstructions to navigation, as, although diligently sought for on several occasions between the years 1815 and 1854, they remain undiscovered. There is nothing in the reports to induce us to believe that they were earthquake shocks: we are instructed that the lead was hove, and soundings obtained, which leads me to conceive that there was an upheaving followed by subsidence, as the soundings at present obtainable in this locality are very deep—2000 fathoms.

I may here mention, that nothing is more difficult to rediscover than isolated portions of rock, even in the vicinity of harbours and roadsteads; how much more so in the open ocean! In the year 1863 the ship "Lightning," one of the Black Ball Line of Australian packets, after clearing Port Philip Heads, but still in charge of the pilot, struck on a rock, but went clear; the ship, not making any water, proceeded on her voyage; the pilot took the bearings of the position; reported the circumstance in Melbourne; went out with some other pilots to discover the hidden danger to vessels passing in and out of Port Philip Heads; *the rock was not to be found;* and opinion varied as to whether the ship struck something moveable, that it was an earthquake, or altogether imaginary. In the mean time the "Lightning" arrived in England, went into dock, and in her bottom was sticking a piece of the rock which the pilots of Melbourne could not discover in the fairway approach to their own port. The rock has since been found, named after the "Lightning," and a buoy placed on it.

My friend, Captain Harris of the "Orient," has mentioned to me an instance somewhat similar:—In the vicinity of the much-frequented port of Dartmouth there is a point of land which, from time immemorial, vessels have been in the habit of rounding close to. Some years since a revenue cutter, in pursuing the same course, struck a rock; the crew had barely time to launch their boat and get clear, when the vessel went down. After a considerable time expended in sounding and diving, a pinnacle of rock was discovered, and removed by blasting. Alas! perhaps many missing vessels have been lost unconsciously, while fearlessly steering a course across the pathless deep, free according to their charts from all impediments to navigation.

Begging to be excused for this digression, I shall return to the volcanic region of the Atlantic. In Lat. 3° N., and 22° W., a ship reported having experienced two shocks, with an interval of an hour between them. Not very far from the same position, in the autumn of 1730 the "Cesar" sighted breakers. Again, in 1860, a ship reported that she grated over what seemed to be a bank of stones, there was a heavy swell running: and the report attributes the sensation to an earthquake.

I now come to the report of three vessels which actually received damage—the "Prince," the "Passadwick," and the "Sea Serpent." In December, 1853, Lat. 0° 54′ N., Long. 26° 50′ W., the "Prince" dragged over some obstruction. When she arrived home, her bottom showed proof of having been in contact with something rough, her copper being very much grazed. In 1859, Lat. 0° 35′ N., Long. 28° 10′ W., the "Sea Serpent" struck what was reported as a shoal, and was considerably damaged.

The Russian corvette, the "Passadwick," picked up the shoal twenty-four hours after the "Sea Serpent," but did not receive so much damage. The position given by these vessels is so constantly visited both by the outward and homeward bound crossing the Equator, that we might reasonably expect, if such dangers existed, they would be more frequently reported.

The fact of there being no breakers or discoloured water suggests an earthquake; then, again, how could a shock travelling through the sea damage a vessel's bottom?

I find a very full report given by Captain Geale of the "Florence Nightingale," who, while prosecuting a voyage in the year 1859, experienced a severe shock of an earthquake, 48 miles North of the Equator, Long. 29° 16′ W., St. Paul's Islands bearing N. W. by N., distance about ten miles. It commenced with a noise resembling distant thunder, and lasted about forty seconds; plates and glasses were fractured, and loose articles about the deck displaced; the ship felt as if grinding heavily on a reef of rocks; the watch below came tumbling up in great haste, the general impression being that the ship was on shore. Captain Geale states that he was much alarmed, ran to the side of the vessel; not seeing any symptoms of shoal water, he recollected that possibly it might be an earthquake; and, no further shock being experienced, the general alarm soon subsided. The sky was clear in the morning, but became overcast towards noon, the atmosphere sultry and oppressive, the sea short and irregular, followed by a heavy swell from the N. E.

In Lat. 1° S., Long. 19° W., the "Circassian" in 1840 saw a sandbank under water, 32 miles South of the Equator, and nearly 18 West. The "Triton" found 23 fathoms; and another vessel in nearly the same position observed *black ashes*, and the sea in violent agitation, in 1835. Recent soundings hereabouts show the sea to be very deep—still we have the evidence of these three vessels which obtained soundings, and specimens of the bottom, stated to be a kind of black sand.

Three other vessels—the "Hutchinson," "Chrysolite" and "Crown" —furnish reports referring to the same latitude with a difference in longitude, probably due to their chronometers. The "Hutchinson" struck twice, but after a few moments went clear; no breakers or discoloured water. The "Chrysolite," drawing 16½ feet, struck the ground. The "Crown" grated for a short time. These latter reports are all of a comparatively recent date, being as late as the year 1835.

The following cases I shall briefly notice, without entering into details. Lat. 0° 57′ N., Long. 41° 0′ W., the "Blaesdale" grounded, and remained fast for ten minutes. Lat. 0° 40′ S., Long. 20° 10′ W., the "Philanthropy" scraped along a bank, and shook for three minutes; she spoke an American vessel which felt the same earthquake. Another vessel, 26 miles South of the Equator, Long. 19° 58′ W., experienced violent shaking, loud rumbling noise; man at the helm could not hold it; described it as an awful earthquake, Feb. 1842. 22 miles South of the Equator, Long. 21° 6′ W., the "Aquilla;" loud rumbling noise under the ship's bottom; sensation like that of a vessel sliding over a rock; rudder so much agitated, the man who was steering could scarcely hold the wheel; no discoloured water, or the smallest ripple. Lat. 2° 43′ N., and Long. 20° 35′ W., the "Krusenstern" reported a volcano in May, 1806; the ship trembled, as if striking upon rocks; would not answer her helm; a cloud of smoke arose about the height of the ship's mast, disappeared suddenly, then rose again and vanished altogether; appeared to be distant about ten or fifteen miles; it could not be a waterspout, or a ship on fire, the smoke rose so high. Doctor Horner was of opinion that, if the whole were not an ocular deception, occasioned by refraction of the rays of light, it must have been a volcanic eruption. As this vessel were employed in an exploring expedition, it is to be regretted that they lost the opportunity of verifying an important physical phenomenon, the excuse made being the approach of night, which prevented them examining it sufficiently close. I think the foregoing affords us ample evidence that there exists one or more centres of submarine volcanic action within the area I have indicated.

I may now mention my personal experience. I sailed on the 9th November last from Adelaide in the ship "Orient" bound to London. The "Orient" is 1000 tons register; her draught of water on the occasion 17 feet. Subsequent to leaving port we encountered strong N. W. gales for four days; on the 16th the weather was damp and overcast, the sun breaking out at intervals; the barometer stood at 29·10; similar weather prevailed during the night. At twenty minutes past seven o'clock on the morning of the 17th I was startled by the most unusual and extraordinary sensation I ever experienced, nor have I ever met anything at all similar in my seven years' voyaging round Cape Horn, or my thirteen years of almost continuous maritime experience. The first sensation was the ship trembling all over, and as if on the point of breaking up; then she felt as if grating over a ledge of rocks. I hurried on deck, where general dismay was depicted on the faces of those present. Captain Harris remarked, that he thought the "Orient" was going down under us. Just as I reached the deck she had passed over the danger, and her stern seemed to be drawn down just as the grating sensation ceased. On ascertaining that the ship did not make any water, confidence was restored, and speculation became rife as to the nature of our adventure: some thought we had passed over a submerged iceberg, others differed in opinion as to its being a newly discovered shoal, with fortunately just sufficient water to carry our ship over, or that it was a submarine volcano; this latter was the opinion of Captain Harris and some other scientific persons on board. The deep sea lead was put over the side as soon as it could be obtained, some two or three minutes after the occurrence; no bottom was found at 50 fathoms. The water was not discoloured, nor was there any unusual agitation; the barometer stood at 28·80, there was no change in the weather before or after to account for the fall of three-tenths, the difference in the reading of the 16th and 17th; the barometer continued to rise every day up to the 27th, when it stood at 3000. The thermometer on the morning of the 17th indicated a temperature of 46, the water 48, the wind N. N. E., moderate. The position of the occurrence, as accurately as we could obtain it, was Lat. 51° 44′ S., Long. 170° 49 E. The Auckland Islands bore about N. E. 210 miles. I may add that the ship's bells rang fore and aft; glasses were displaced from the rack in the saloon; the ship's compasses were not affected; the rudder moved freely; there was no difficulty experienced in steering, nor did the man at the wheel notice anything peculiar, except the drawing down of the ship's stern.

Taking advantage of my being in London a few days since, I visited the "Orient" for the purpose of ascertaining if she exhibited any trace on her copper of being in contact with anything, the impression being still very strong on my mind that she had grated over a shoal. The ship had just come out of dry dock, where she had been carefully examined, but not the slightest trace or evidence of her being in contact with the ground could be discovered. We must, therefore, come to the conclusion that the occurrence I have narrated was occasioned by a volcanic shock. Still it does appear to me most difficult to understand how any vibration or earthquake shock passing through water so deep could produce a sensation so exactly similar to that of going over a solid obstruction. I may here point out on the chart and diagram before you, some of the reported shoals and earthquake shocks I have just referred to. Having drawn your attention to the evidences we have of submarine volcanic action, I may remind you that we have many islands in the southern seas at a considerable distance apart from each other, the majority of which, although exhibiting no evidence of active volcanic agency at present, are yet records of what once took place in this vast ocean.

The Island of Annabon, in the Bite of Biafra, is one of four volcanic islands—the other three being St. Thomas, Prince, and Fernandi Po. The truncated pyramidal peak Dofogo, in the island of Annabon, has an elevation of 3250 feet. These islands lie in a line of direction S. S. W. and N. N. E. with the volcano of Leba, 13,000 feet high, in the Cameroon range of African mountains

Fernando di Noranha, 800 feet with its group of small islets, is distinctly volcanic; there is no crater in this island. Ascension, 2867 feet, has basaltic lavas; masses of scoria have been thrown out from the Green Mountain, where also are to be found angular fragments of granite. On the Western aspect is a large open crater; numerous volcanic bombs, twelve inches in diameter, lie scattered about.

St. Helena, 2692 feet, is entirely volcanic; near the shore the rocks are basaltic, traversed by dykes. In the interior are beds of lava. Between Diana's Peak and Nest Lodge are the remains of a great crater; here scoria and cellular lava abound. Trinidad, 2020 feet, is a mass of volcanic rock, rising abruptly from the sea. The interior is chiefly composed of greenstone; the Sugar Loaf Hill, and the Nine-pin Rock of Trap. The Nine-pin Rock is 850 feet high, in the form of an exquisitely proportioned column. The small islands of Martinvas, in the vicinity, are also volcanic. Tristan d' Acunha 8300 feet, as also Nightingale and the other islands adjacent, are volcanic.

Thompson and Bouvet Islands, Lat. 54° S., are masses of volcanic rock, traversed by veins of lava, presenting a vitrified appearance: black, white, blue and green, sparkling in the sunshine of this icy region, present unmistakeable signs of the origin of these islands. Bridgman Island, one of the South Shetland group, still sends forth hot vapours amid its beds of ice. In the island of Deception, in 1842, flames were seen to issue from thirteen distinct points. In all this group obsidian, black ashes, and pumice abound.

The islands discovered, or rather rediscovered by Captain O'Donnel, of the "James Baines," in Lat. 53° S., are probably, judging from the description given by him, volcanic, and possibly of a more recent date than other portions of isolated land in the South Atlantic.

Some years since I sighted the Crozettes, or Desert Islands: from the peaked appearance of the land, it was at first mistaken for an iceberg. The shape and general aspect of these islands reasonably lead us to believe that they are of similar origin.

However, there can be no doubt about New Zealand and the Aucklands. The capital of New Zealand is, in fact, founded on an extinct volcano. Earthquake shocks are not unfrequent in Wellington Straits. The sea level has undergone considerable change at Taranakee; the water flows over what a few years since was dry land, and rollers come in on the coast at intervals, which is attributed to submarine volcanic eruptions. Indeed, from what I have heard of these islands, I assume that they are situated in one of the volcanic centres of the South Pacific Ocean. Possibly the "Orient" passed over another.

Diego Ramarezes Islands, and indeed all the islands forming the Cape Horn group, are volcanic, while the Falklands and South Georgia exhibit no evidence of volcanic origin. Much of the land discovered within the Antarctic Circle is described as volcanic; and most of us remember Sir James Ross's graphic description of the eruption of Mount Erebus within the stupendous icy barrier of the Antarctic Zone. North of the Equator, and within the area that I have already dwelt on, St. Paul's Islands remain a record of some past submarine convulsion.

In the vicinity of St. Michael's, one of the Western Islands, at the commencement of the present century, an island was thrown up in one night, without any remarkable circumstance to attract the attention of the inhabitants of Villa Franca, who were astonished when they awoke in the morning to find an island where the day before was deep water. A fisherman went to reside on it; but the island went down one night, taking the fisherman and family with it, leaving a dangerous reef which still obstructs the entrance to the harbour of Villa Franca. I may remark that St. Michael's still possesses an active volcano.

I need scarcely mention the volcanic action going on in the Mediterranean at present. The beautiful engraving in the "Illustrated London News" of the submarine volcano and Island of Santorin, has probably been seen by most persons present; but a few general remarks on earthquakes may not be deemed an inappropriate conclusion to this paper. The destruction of life and property occasioned by them, and the mysteriousness of their cause, have at all times forced them on the attention of mankind. It is estimated that upwards of a dozen earthquakes, destructive of life and property, occur upon the surface of the globe every year. Fertile districts have been laid waste, and enormous numbers of human beings destroyed; sixty thousand perished in the great Lisbon earthquake; by an earthquake in Calabria forty thousand were destroyed; and it is estimated that as many as thirteen millions of the human race have thus perished. No portion of the earth's surface is free from earthquakes. Egypt has been more exempt than any other country; but there is a record of one which took place in the year 1740.

The cause of earthquakes is very obscure, and many theories have been brought forward to account for them. All agree as to their connexion with volcanoes, and that they are produced by the same subterranean agency. Sir Humphrey Davy, when he discovered the metallic basis, suggested the idea that those metals might abound in an unoxidized state beneath the crust of the earth; and that when water came in contact with them gaseous matter would be set free, sufficient to produce the earthquake; the metals would combine with the oxygen of the water, and the heat evolved melt the surrounding rocks.

Mr. Mallet looks on an earthquake as the transit of a wave of elastic compression, in any direction, vertical or horizontal, through the crust of the earth, from a centre of impulse, attended by tidal and sound waves, influenced by the circumstances of position as to sea and land. He assumes that the centre of disturbance must be always near a large supply of water. He conceives that, when an eruption takes place at the bottom of the sea, large fissures are opened, through which the water is poured on to a heated surface, and assumes the spheroidal state. No impulse at this time will travel far, except the trembling which precedes the shock. When the water comes in contact with a cooler surface, then a vast volume of steam is evolved into the deep and cold water of the sea. The power thus set free at the volcanic focus is transferred in all directions, and constitutes the true earthquake shock. It travels with immense velocity from the centre of impulse; the rate of translation being as much as thirty miles an hour, its amplitude several miles. During the passage of the main undulation, a continuous tremor, with a short quick action, like a chopping sea, is often felt; this arises from secondary waves, like the small curling swell often seen on the surface of the ocean. When the roll reaches the sea, it lifts the water, and carries it in an elongated heap far out into the deep. The shock of the Lisbon Earthquake was felt in Finland, Canada, and some of the West India Islands—an area of 7,500,000 square miles. Supposing that but twenty miles of the earth's crust were moved, then 150,000,000 cubic miles of solid matter were displaced. The returning wave at Cadiz was sixty feet high: the power evoked must have been truly fearful.

Recently a missionary vessel was swept along by the force of one of these volcanic rollers, until she came in contact with a reef, over which she was fairly carried, and wrecked to leeward among coral rocks. Some years since a number of these rollers, on a fine calm day, poured into the anchorage at St. Helena, tearing the vessels from their moorings, and casting them on shore without the slightest warning. In deep water these waves may be so long as to pass under a ship without being observed; but on a sloping shore the depth of water becomes less than the altitude of the waves, and breaks on the shore with great force, in some instances extending far inland.

The least destructive form of earthquake is the undulatory. If the motion is perpendicular, the devastatation occasioned is frightful; either radiating from a centre, or extending over a considerable line, according to the nature of the original impulse. Sometimes only a few shocks occur, but of sufficient force to spread desolation over hundreds of miles; in other cases as many as 200 have been experienced in twenty-four hours.

Humboldt remarks that, if we were aware of the daily condition of the earth's surface, we should probably ascertain that the earth is always undergoing shocks at some points of its surface. Some very important permanent results remain after great earthquakes; elevations and subsidence are the consequences of those throes.

The power of the great sea wave already alluded to was very remarkable in the Jamaica earthquake of 1692. We read that the "Swan" Frigate, which was lying at the wharf at Port Royal, was borne by it over the tops of houses, and that many persons escaped by clinging to her. Vessels in the vicinity of the island felt the shock of this earthquake severely. On board of one ship, 100 miles from the coast, the men on deck were violently thrown upwards to the height of a foot and a half.

On the coast of Chili and Peru rollers attributed to submarine volcanic action occasion vessels to drive from their anchors, and sometimes cause their destruction.

In conclusion, I may indicate the geographical position of some of the islands which I have referred to in the paper I have had the honour of reading to this meeting.

IV.—*On Orchis Mascula with Double Flowers.* By DAVID MOORE, PH. D., Director of the Royal Dublin Society's Botanic Garden, Glasnevin.

[Read May 15, 1865.]

IN the October number of "Seemann's Journal of Botany" for 1864, I noticed the discovery of *Orchis pyramidalis* with double flowers in the county of Clare, by F. G. Foot, Esq., and described the changes which appeared to me to have taken place in the parts of the flower to render it double. That being the first instance on record of the species having been found in that state, it was looked on with considerable interest by botanists.

Dr. Masters, of London, again noticed the matter in the number of the same work for December, and gave farther details of the changes which took place in the parts of the flower.

Another interesting instance of one of our native species of Orchis has just been sent to me this morning from the Bridge of Allan by Dr. Patterson, one of the resident physicians there. It is an early *Orchis mascula*, and the first time I believe it to have been ever seen with double flowers. Happily, the parts are so large, that the nature of the morphological changes which have taken place can be well studied.

Moquin-Tandon, in his "Elements de Teratalogie," classifies the prolifications which take place in causing double flowers as *median*, *axillary*, and *lateral*:—*Median*, when the centre of the flower is changed and prolonged beyond its usual state, and leaving other buds, as frequently occurs in the rose; *axillary*, when the prolification springs from the axil of one of the parts of the flower; and *lateral*, when the addition is rather to the inflorescence than to the flower itself. The remarkable changes which have taken place in the flowers of this Orchis appear to embrace two of these terms—*median* and *axillary*.

The flowers are reversed on the rachis of the axis which bears them, the labellum being next the apex, in place of the sepals being uppermost, which is the normal state of the flower. The changes of the parts are very curious and interesting. On the sides of the labellum are two smaller labella with short spurs, and in the axils of these other flowers spring, thus rendering the morphology *axillary*. These secondary florets have, again, rudimentary florets in the axils of their changed labella. There is no ovary, or column, or nectary distinct, though in some instances in the secondary flower they are apparently present in a very rudimentary state. The part where the column ought to be in the general flower is a mass of bracts and incipient florets, forming a depressed raceme—thus showing the prolification to be *median* also.

The malformed parts in the incipient flowers do not appear to exceed the usual number of pieces in the regular flower of Orchis.

This is supposed to be the second instance of *median* prolification in forming the double flower of an Orchis, the first being that already noticed by Dr. Masters, relative to Mr. Foot's. *Orchis pyramidalis*, which I sent to "Seemann's Journal of Botany."

I have now another remarkable instance of duplication in an Orchid flower, though caused in a very different manner from that of the former. It is the beautiful *Calanthe veratrifolia*, a tropical species. The alteration in this instance has occurred by the blending of three flowers into one, and is only partial on the raceme. The three flowers are attached to one solid peduncle, which springs from the rachis between two bracts, in place of one, which is the normal condition of the flowers. Each has its proper labellum, column, and pollen masses; but there are only ten pieces of sepals and petals, in place of fifteen, which would have been the case had the flowers been separate and normal. The spur on the middle flower is wanting, and in place of it are two petaloid pieces with green tips.

It is further worthy of notice, that the flower on the rachis, which is immediately under the malformed one described, is without a labellum altogether.

V.—*On Labourers' Dwellings—Successes and Failures of Efforts to improve them by means of Inspection, Loans, and Public Companies; and the Expediency of extending to Ireland the Compulsory Principle in their Erection and Maintenance.* By E. D. MAPOTHER, M. D., Professor of Hygiene, Royal College of Surgeons, Ireland; Surgeon to St. Vincent's Hospital, &c.

[Read May 28, 1866.]

EVORY KENNEDY, M. D., in the Chair.

SINCE I placed this paper on the Society's list many unexpected demands have been made on my time, and in this way I account for many imperfections which I fear you will perceive in its arrangements and fulness. The subject of the dwellings of the labouring classes presents itself in so many aspects, and there are so many professional gentlemen and landed proprietors present, whom I am anxious to engage in the discussion, that it will be best brought before you by my making my own observations as brief as possible.

The dwellings of the poor in cities, towns, and rural districts in Ireland, are ill-constructed, dilapidated, overcrowded, and unwholesome. Let me attempt the description of one or two in each of these situations. Gill Square is a blind court, opening by a narrow archway, under one of the houses in Cole-alley, Meath-street, in this city. In it there are nine three-story houses, built on three of the sides of a square of about fifty feet; the roofs are broken, the walls present a most unsafe and tumbledown aspect, the windows are boarded up for more than half their space; every room is to the utmost overcrowded with beings whose dirty, ill-clad, and spiritless aspect it is saddening to behold; there is but one yard for all; and in this, till last year, there was a hovel, about ten feet high and eight square, in which three adults were huddled. Here, however, time has wrought improvement, for there now remains but a heap of rubbish. If I had time, or if it were my province to depict the moral features of the denizens, they would appear of even a more degraded character than the buildings, and of no place could the words of Kingsley be more truly descriptive—

> "I turned into an alley 'neath the wall—
> And stepped from earth to hell. The light of heaven,
> The common air was narrow, gross and dun—
> The tiles did drop from the eves; the unhinged doors
> Tottered o'er inky pools, where reeked and curdled
> The offal of a life; the gaunt-haunched swine
> Growled at their christened playmates o'er the scraps.
> Shrill mothers cursed; wan children wailed; sharp coughs
> Rang thro' the crazy chambers; hungry eyes
> Glared dumb reproach."

In a neighbouring house in Cole-alley, some years ago, twenty people were found lying in one room, of whom five were ill with fever; and Mr. N. Robinson has ascertained that in the 171 rooms of this alley there exists an average of over five persons.

56, Bow-lane, West, I have described in a recent report to the Corporation, as follows:—Hall and stairs covered with three inches of crusted filth; first flight so rickety as to be unsafe; second without a bannister; floor of second landing broken into two holes about a square foot each, dangerous to life and limb; ceilings of both top floors broken, and let in rain; no lower sash in window of back room, so that it had to be covered with a petticoat nailed over it—such state would produce colds and rheumatism; filthy privy, and back yard without a sewer—prolific causes of diarrhœa.

Poverty of the owners is not the cause of the dilapidation of these abodes; for the persons who set them—like many of their class—have raised themselves to comparative affluence by profits thus gained from the poor.

There is much of this kind of property owned by respectable persons, who never enter it, but leave it to be managed by the "deputy" or agent, who is not usually of an improving spirit. In proportion to space such tenement houses are highly rented—far more so than the gentleman's house.

In Cork things are no better, as we learn from recent reports of the Sanitary Committee. "The overcrowding of the wretched tenements in which they live, each house containing several families, ranging in the aggregate, in some instances, from thirty to sixty human beings, male and female, in each house; for which large rents are exacted by the landlords, who will not spend one penny in the cleansing or improvement of their houses, unless coerced by force of the law to do so. Your committee have learned that a practice prevails amongst poor families occupying rooms in these houses, to under-let a portion of their rooms to nightly lodgers—an evil which it appears to your committee might be met by the enforcement of the Lodging House Act." Such were the worst parts of London—undrained, dilapidated, and thinned by pestilence every few years before the fire of 1666, which therefore cannot be regarded from every point of view as a calamity.

The labourers' cottages in such small towns as Chapelizod, Navan, Carrick-on-Suir, or Ennis, are usually built in lanes, and are often placed back to back, excluding all chance of thorough airing, or the provision of sanitary accommodation. They consist of a single room, or a living room, and a sleeping place of about twelve feet square, and eight feet high, which offers for the breathing of the five inmates (the average) and the vagrant, who is almost invariably accommodated with a night's lodging, about 192 feet of space, 1000 being the average in public institutions. This would not be so hurtful if there were any means of renewing the air within it; but from the absence of a chimney in the sleeping room, which is usual, and the small size and immovable state of the windows, no ventilation occurs. In such an overcrowded state there can be no decent separation of the sexes. When a death from contagious disease occurs in such an abode, the retention of the body within it is fraught with fearful evils; and since the abolition of the Vestry Act there were no funds for interment; and if the relatives were unable to provide them, they had to beg the amount from the neighbours. Sir Hervey Bruce has, however, obtained an Act this session which empowers poor law guardians to bear the expenses of interment.

Neither in such a room can ablution of the whole body be accomplished; and I have frequently found persons (especially females) suffering from skin diseases and other maladies, who for many years had never washed any part of their bodies but the face, neck, and hands.

Evictions, and the demolition of cabins in the rural districts, have driven agricultural labourers into the small towns; and, as new abodes in the place of those removed would be subject to taxation, they have not been erected. Besides the fearful overcrowding thus induced, the labourers have to expend their strength in walking long distances to their work. The remedy is that which followed in England last session, upon a masterly demonstration of its necessity by Dr. Hunter, of the Medical Department of the Privy Council—namely, union rating, for which a Bill has been introduced by the Members for Dungarvan and Limerick.

The mud hovel of the Southern and Western peasant is too well known by the sketches of English tourists to need any description here. Planted anywhere, regardless of situation or soil, the low walls, the black, half-rotten thatch, the want of any proper flue or of windows (for the hole filled with an immovable and partly glazed sash cannot be so regarded), the clay floor, which becomes soaked with the pigs' food or more dangerous filth, and the adjacent manure heap, are all highly promotive of disease. From the want of a back door, thorough airing can never be effected.

The admission of domestic animals, the pig especially, has done much to propagate measles and other parasitic diseases, which are afterwards injurious to man when their flesh is used.

Mr. Godwin, of the "Builder," has often quoted the description of the way in which the inmates are disposed, as observed by a medical friend of mine:—"Generally the pigs dwell beneath the beds, the human tenants in them, and the poultry overhead; the people can enjoy the prospect of bacon and chickens, which, however, they never taste."

If there be an inner room, it is close and stifling, and so ill-lit, that, when the doctor pays his visit in the daytime, a candle is required to permit him to see his patient.

There are in Ireland, according to the last census, 89,374 mud or sod hovels of one room only, and 489,668 mud houses with more than one room, giving an increase in Connaught of 5168 of the latter class since 1841. The average number of persons occupying each of these dwellings is, in towns, 4·53; and in the rural districts, 5·24.

Now, the remedy for this deplorable state does not lie in the labourer's hands, however great his willingness to pay for better accommodation, but with the landlord, when he recognises the duties which appertain to his property.

Many diseases are produced, promoted, or rendered more fatal among the poor, and, if contagious, spread to the rich, by such conditions as I have sketched.

(*a.*) Fever.—The man who is depressed by the want of fresh air is more liable to catch contagious disease; and in an overcrowded, ill-aired room it must spread to others when one is stricken down. During the epidemic of the first quarter of this century, the practice when fever seized a cottager was to build off the part of the room in which he lay, and to introduce through the window any food or medicine he required. A more disastrous consequence of the ignorance among the people of the laws of health perhaps never occurred. One and a half million of cases was reported in the epidemic of 1818. The fever rate of Irish towns is constantly and fearfully higher than that of English towns, owing to defective house accommodation and the reception of vagrants, who spread the contagion.

(*b.*) Diarrhœa must always prevail, and typhoid fever and cholera, when introduced, must spread, if there be no efficient means for the removal of refuse, and if it be allowed to soak around the dwellings and poison the wells and the atmosphere. Gastric fever is a usual pest of the cottager's children, and is produced in the same way.

(*c.*) Convulsions carry off so many infants in Irish towns as to greatly raise their mortality; and this disease is the effect of impure air acting on the susceptible nervous system of infancy.

(*d.*) Consumption and other forms of scrofula are, without doubt, promoted by want of pure fresh air, and are becoming lamentably fatal in many of our Northern towns.

(e.) Accidental deaths occur likewise by overcrowding; thus during the last ten years, in Liverpool, 828 deaths of infants have been caused by overlying.

The other physical and the moral evils which result from the wretched condition of the habitations of our poor I shall not now touch on, but they are subjects pre-eminently important for the philanthropist and the statesman. The evils which neglected dwellings impress on our countrymen are carried with them when they emigrate to British and American cities, in which the term "Irish" applied to a neighbourhood is the synonym for "wretched and filthy;" and, galling to our national pride as the expression is, no candid man can deny that there is some truth in it. It becomes the duty of every man to lend his aid in removing the causes which lead to such universally recognised degradation.

The means which legislation has heretofore provided for the improvement of the dwellings of the humbler classes have been inspection, and the advancement of Government loans.

Inspection in towns in Ireland is only allowed in nightly lodging houses duly registered, and only when the population exceeds 3000, and the town has been placed under Commissioners by the adoption of the Improvement Act of 1854. In England exemption is only granted for those below 200, and in Scotland below 700. Overcrowding is thus irrepressible in hundreds of towns which fall below that population; and in Parsonstown, Arklow, Kilrush, Portlaw, Roscrea, Macroom, and Boyle, although above it, because they have not adopted any Improvement Act. As an example of a town which is overcrowded by the reception of vagrants at night, I may mention one very near us—namely, Swords. As few of the towns which have adopted the Act of 1854 employ any inspector, it follows that nightly lodging houses are unregulated in Ireland, except in a few of the larger cities.

Power to inspect the tenemented dwellings of the poor in the same way as common lodging houses has been advocated by the ablest writers, and first and most forcibly by the Rev. Charles Kingsley; but Dublin is the only city in these kingdoms to which it has been granted.

Such powers were conferred last year under the Dublin Improvement Act, and are now anxiously sought for by London and other English cities, through their health officers and representatives. Under the Improvement Act of 1849, by-laws were already in force regarding the following matters over nightly lodging houses:—Registration; inspection; number of lodgers; separation of male and female lodgers; airing and cleansing; notice of infectious disease and disinfection; water supply, and domestic accommodation; exclusion of swine and other animals; and the keeping of a copy of the regulations in each room.

Ninety-five such houses were registered, and regularly inspected, and one single fact will prove with what advantage. An average of one case of fever yearly occurred in the whole of them, whereas nearly every tenement house produced a case.

Such considerations induced the Corporation to seek power over tenements set weekly, at rents under 3s.; and the Lord Lieutenant sanctioned by-laws respecting the condition of roof, walls, windows, house drain, and other sanitary requisites, and imposing penalties on the owner for neglect in these respects, and on the occupier for any offence in injuring or abusing such accommodations. The owners of some of these houses, which number about 9000 of the entire houses in the city, at once organized themselves into a body, with the grandiloquent and scarcely intelligible title of "The Antipolitical Ratepayers' Protective Association," whose object was to protect themselves from the outlay necessary to render the houses fit for human habitation. By representations that the dwellings of the poor were in excellent order, that the Corporation were about to apply the by-laws for the regulation of furnished nightly lodging houses to tenement dwellings, by memorializing that body, and threatening many of its members with opposition at the next election, and by appeals to the police magistrates, they have as yet to a certain degree impeded us, notwithstanding the deplorable state of houses, such as I have exemplified, in Gill-square and Bow-lane. On Wednesday last, however (the question having been argued by most eminent counsel), the magistrates decided in favour of the Sanitary Committee, and fined the Secretary of the Tenement Owners' Society for not having registered a house kept by him. So determined are their efforts to oppose us in carrying out the sanitary by-laws, that they have lodged an appeal to the Queen's Bench. They complain that the term "common lodging house" is an opprobrious epithet to apply to houses set in tenements. The difficulties of keeping a registry of 9000 houses with changing owners are so great, that I trust some future Act may declare registration unnecessary for "tenement houses," as distinguished from common lodging houses," in which such a system is required.

The by-laws came into action on the 15th day of September, and the sanitary sergeants forthwith proceeded to enforce them. Those neighbourhoods which from experience were known to be most filthy and unhealthy were first visited, a copy of the by-laws was posted in each house, and a familiar explanation of their provisions was given to each occupier of a tenement in it. In many instances the improvements which the sanitary sergeants suggested were carried out; in others they were resisted, and the owners were accordingly summoned. The police magistrates, however, adjudged that registration of each of these houses as a public lodging house was necessary before conviction for any sanitary deficiency could be obtained. The registration of these houses, which number about 9000, has caused considerable delay, and occupied the time of the staff for the first four months. I should mention that the visits of the officers were always most gratefully received by the poor tenants, and the allegations of the house owners as to their being intrusions on their privacy and liberty were quite unfounded. During the eight months the Act has been in operation, 8974 houses have been visited, 92,707 sanitary defects discovered, and the larger proportion of them corrected.

It is most gratifying to know that in the amended sanitary legislation, which the Government have promised this session, the power of regulating tenement houses will be extended to all other Irish towns, as well as the power to prevent overcrowding as at present possessed by English Acts.

The Act for the inspection and regulation of lodging houses in England, obtained by Lord Shaftesbury, was followed in 1851 by the Act to encourage the establishment of lodging houses for the labouring classes, which provided that in towns of 10,000 inhabitants the local authority might borrow money from the Loan Commissioners for the purpose of building wholesome dwellings for the labouring classes. The desire to improve the condition of the operative classes in English towns is so general, that I was surprised and disappointed to find that the Act has been only taken advantage of in one instance during the fifteen years it has existed. In that instance (Huddersfield) the success has been remarkable. In 1864 it provided for 40,928 nightly inmates, at a profit of £90 14*s.* 1*d.*; and in thirty years the establishment will be the property of the Town Council, principal and interest having been paid. This Act being thus a dead letter, the "Labouring Classes Dwellings Act" (just passed through the efforts of Mr. Childers) extends the granting of loans for this purpose to public companies and to individuals who can offer fit security at 4 per cent., and repayable over forty years. A similar bill for Ireland, introduced by Mr. Childers and the Attorney-General, has obtained a third reading; and it possesses a valuable additional clause, providing that buildings, ruinous or dilapidated because of defect of title, may be sold in the Landed Estates Court.

Such Acts are perfect as permissive enactments; but, for reasons I will just now mention, I fear that, as in the case of the Act of 1851, the supineness of municipal bodies and landed proprietors will to a great extent render them nugatory.

In 1855 Sir W. Somerville and Mr. G. A. Hamilton obtained an Act which much facilitated the improvement of labourers' dwellings, by granting the power to the landlord to recover possession, under the Summary Jurisdiction Act, of any tenement or cottage of a labourer, which, having been previously provided with every sanitary appliance, had fallen into dilapidation. The same member, after some unsuccessful efforts, procured the enactment of the statute sanctioning the granting of loans on most favourable terms to landed proprietors for the erection of agricultural labourers' dwellings; and the Commissioners of Public Works, to whom the management of the statute was intrusted, published regulations and specifications for the work. They also offered plans for the buildings, to which, however, the proprietors were not bound to adhere. No loan was to be granted for repair of old houses; the sum was to range between £200 and £1000 for any one person; and no larger sum than £60 was granted for each cottage, one-fourth that sum being added by the landlord, who was also obliged to provide for each dwelling a properly-drained privy; ashpit, with puddled walls, and yard. Most glowing anticipations were entertained as to its effects in improving the wretched habitations of our peasantry; but I regret to say that they have been realized to a very inconsiderable extent. More than half the time of the Act has run (for it is to cease in 1870), yet, according to the last Report of the Commissioners (1865) but nine loans, amounting to £4900, have been sanctioned for dwellings completed. If £60, the usual loan, be divided into this, it may be supposed that about eighty cottages have been erected. Considering that there were in 1861 at least 200,000 cottages requiring to be rebuilt, and that the overcrowded state of labourers' dwellings is so notorious, it is much to be deplored that landed proprietors have not taken advantage of this admirable enactment in a degree at all adequate to the wants of their tenants. From the same report it appears that eighteen loans, amounting to £6290, were sanctioned, but not proceeded with; and that sixteen, amounting to £8800, had been about half completed.

A stroll over the Hill of Howth will practically convince any one of the advantages of the Act; in few parts of Connaught could more wretched hovels be discovered than existed here some years ago. Now their places are taken by several neat and wholesome dwellings for the labourers, which are set at highly remunerative rents. The cottages are kept in excellent order, and the same gratifying report may be made of many others of those erected under the Act.

Many counties—for example, Galway, Mayo, Leitrim, and Roscommon, or nine-tenths of the Western province, which most sadly require improved dwellings, have never had a loan granted, no application, I presume, having been made by the owners of the soil.

In the working of the Act there is a serious difficulty, which, I trust, may be removed by future legislation. I can best explain it by an example. A landed proprietor in the South, having a large tract of unimproved land, let it to good tenants in small holdings, and granted long leases. His property has been vastly improved, and his tenants aided in the safest way. Instead of being rewarded, however, by the benefits of this Act, he is ineligible from receiving loans under it by the fact of having given leases; and, further, the tenants are incapacitated by the smallness of their holdings from seeking the responsibility of a loan of £200, the least to be advanced under the Commissioners' regulations.

Scotland has enjoyed a similar act, which has been largely taken advantage of by land owners there. Until Mr. Childers' Act of this session landed proprietors in England had not similar privileges.

Throughout this country there are a few large landed proprietors who have interested themselves in the improvement of their labourers' dwellings before this Act had been passed for Ireland; and the pretty and healtful cottages at Loughcrew, Clermont Park, Enniskerry, and Santry, occur to me in illustration. The Royal Agricultural Society has aided the good work by offering several gold and silver medals for the erection of the greatest number of newly-built labourers' cottages, or of improved cottages, in each province, or county, or district of its local branches. There is also the Leinster Challenge Cup, for the person who, during the year, shall have erected the greatest number of improved labourers' cottages in any part of Ireland. Stimulated by these rewards, some hundreds of cottages have been built and put in competition, as appears from the yearly reports of the Society.

With regard to the plans on which these dwellings should be constructed, I will not, of course, attempt to enter into details; but I exhibit these models from the Agricultural Museum of our Society, representing some which have been erected; and these elevations and plans for a pair of labourers' cottages have been drawn by my brother, Mr. Dillon Mapother, C. E., of Louisville, U. S. They are adaptable for a small or large family by extension of the partitions; and, as all ornament is omitted, the expense would range between £60 and £75 each, every sanitary requisite being provided.

These other plans are being carried out on the premises of Messrs. Walpole and Webb, and, at Bray, under the direction of Mr. C. Geoghegan, architect; and are intended to accommodate four families in each building.

There are also on the table several valuable plans, which have been kindly lent to me by Mr. Barry, Commissioner of Fisheries, who has laboured longer and more energetically on the subject than any one with whom I am acquainted. A friend has informed me that cottages are made for a very small sum in France, by moulding in wooden shapes the scrapings from the streets; but I fear that, like the mud cabins, they would not allow permeation of air. In London and other great cities the greatest advantages with respect to health, prosperity, and morality, have followed the erection of improved lodging houses and family dwellings for the working classes. They have been in many instances highly remunerative, even up to 14 per cent. on the outlay. In other cases, where the noble benevolence of Mr. Peabody and others justified a greater expenditure than could be recouped in rents, the return has been as low as 3 per cent. Perhaps the Cromwell, Tower, Cobden, and Stanley buildings of the Industrial Tenement Company, which accommodate 200 families on the open staircase principle, may be taken as a medium. The profit from these has ranged from 6½ to 9 per cent.

Much has been done in London towards providing fit dwelling for the humbler classes; but so great is the aggregation of people reared in the country, and so vast the demolition by railway and other works, that overcrowding is most excessive, and typhus is yearly increasing. Mr. Thomas Hughes was therefore justified in moving this week, in Committee on Railway Clauses Bill, that compensation should be given to tenement holders where more than fourteen houses in a parish have been removed; and that the Company should provide wholesome dwellings in place of those removed, and should have compulsory power of taking sites for the purpose. He is favourable to the system of providing dwellings out of the city, the railways to provide cheap trains. This principle has been largely adopted in France; and, as far as it has been tried in London, it has succeeded. In Irish cities the condensation of population is not so great as to need this. In that most comprehensive and delightfully-written book, "The Homes of the Working Classes," by Mr. Hole, there are most interesting descriptions of Saltaire, Akroydon, the familistery at Guise, and the *Cités Ouvrières* of Mulhouse, where most admirable villages have been constructed for manufacturers' workmen.

In Edinburgh, 16 buildings, accommodating 847 families, have been erected, and they have all been pecuniarily successful.

In this city something in this direction is at last about to be done. The Industrial Tenements Company (Limited) has just been established with a most influential directory, who have entered into the movement in a spirit of commercial enterprise, which alone can make the project remunerative, and on a scale adequate to the wants of our labouring population. From their prospectus I make the following extracts:—

"This Company has been formed for the purpose of remedying an evil that exists in the city of Dublin, and of providing for the poor and labouring classes tenements in every respect superior to their present unhealthy and miserable dwellings.

"The Company propose to acquire, by purchase or lease, in the city of Dublin, old but substantial houses, which, owing to the decline of the locality in which they stand, can now be purchased or obtained on lease for long terms of years on advantageous terms, and by an economic outlay fit up these houses in tenements, providing each set with all sanitary requirements, thereby insuring to the labouring man the elements of health, cleanliness, and comfort.

"The Company also contemplate erecting improved dwellings on the principle adopted with such signal success in London, Edinburgh, and all the leading cities of Europe.

"There are at present 9000 houses let in tenements throughout the city of Dublin, in very few of which (if any) is the sanitary condition of the occupant cared for, and in nearly all of which the common decencies of life are lost sight of, whilst in most cases the rents paid for these tenements are exorbitant for the accommodation afforded.

"From the working of the Improved Dwelling Companies in London, it has been found that the artisan and labouring classes are most punctual in the payment of their rents, and that every vacant tenement is eagerly sought after.

"The Company have ascertained that there are most suitable lots of houses in the city of Dublin, that can be obtained on advantageous terms.

"The preliminary expenses are confined to the actual outlay incidental to the formation of the Company, no promotion money or any payment of a like nature being sanctioned by the Articles of Association.

"The promoters have been induced to divide the capital into £10 shares, in the hope of inviting the artisan to invest his savings in the undertaking, and thus give him an additional incentive to promote the prosperity of the Company."

The financial success of improved dwellings erected in this city by Mr. Thomas Vance, Dr. Evory Kennedy, and Mr. Lindsay, has been remarkable; and there are always many eager applicants for tenements when vacant, which facts augur well for the success of the Company.

The most important measure in regard to the subject ever introduced is that which Messrs. McCullagh Torrens, Locke, and Kinnaird brought in on the 20th of February. It is entitled, "A Bill to provide better Dwellings for Artisans and Labourers," and applies to any borough or district in England to which the Public Health Act has been granted, or any place in the Metropolis governed by a vestry. It provides that, upon application of twenty ratepayers of any town, parish, or district, or by resolution of the local authority, whenever the death rate for three successive years shall have been over three in the hundred, the Home Secretary shall send an inspecting architect to inquire into the sanitary state of any street, the number of persons living in it, the space and accommodation afforded, and the steps necessary to obtain sufficient healthful houses for the inhabitants. His report shall be laid before the local authorities, published within fourteen days; and, unless within a month the local authority shall prove to the Home Secretary that the improvements are not needed, he shall order them to be executed within a reasonable time. The dwellings to be constructed in lieu of those condemned shall be built with every sanitary accommodation, and so as to afford 350 cubic feet of space for every occupant. For these buildings the Loan Commissioners may advance money on the security of the rates at 3½ per cent., to be repaid within thirty years by equal yearly instalments. The local authority is to have power to take land or sites for buildings, giving compensation to the owners, and is to manage the improved dwellings. From this latter responsibility they will be relieved after three years by a clause which Mr. Torrens has undertaken to insert. I think some clause empowering the authorities in very condensed populations to convert the sites of the condemned houses into open spaces is very desirable, the displaced inmates to be provided for in suburban districts connected with a railway, at penny fares.

The compulsory principle on the occurrence of a fearful death rate is a peculiar and valuable feature of this bill, and without it no considerable amount of improvement will be achieved in the dwellings of the industrial classes. This is conclusively shown by the facts I have before mentioned—namely, that the Loan Act in England has in fifteen years procured the building of one house, and the Irish Loan Act has in six years been instrumental in the building of some eighty cottages. As the former failure and the want of sanitary improvements in Irish towns is attributable to the apathy and mistaken parsimony of local authorities, I rejoice that in the Labouring Classes' Dwellings, Ireland, Act, it is provided that loans may be also granted to public companies and estated individuals. So ill understood and so uncared for is the condition of the humbler classes in towns, that when that mild and permissive measure was passing through committee, it was characterized as "a monstrous bill" by an Irish county member. Mr. Torrens' bill has been referred to an admirably chosen select Committee, who have not as yet reported. Meanwhile, thirty-seven bodies have petitioned in favour of it, and two against. The Dublin Corporation and the Irish Medical Association have petitioned for its extension to Ireland.

A joint Committee of the Society of Arts and the Social Science Association has prepared a bill, entitled, "The Improvement of Dwellings for Labourers and Artisans Act, 1866," which Mr. Charles Buxton is to introduce. It gives compulsory powers to corporations to take land and build dwellings, the Home Secretary sanctioning the steps, and the advance of loans for the purpose. It contains the usual selfish clause, "This clause shall not extend to Scotland or Ireland." It seems to me but to complicate attempts at legislation, for Mr. Torrens' bill better provides for the same objects.

The Metropolis, Liverpool, Birmingham, and other large English towns possess local Acts for the complete regulation of their buildings, and the smaller towns are similarly provided for under the by-laws of the Local Government Act, 1858. Under these powers, no house can be built unless its walls be of certain thickness proportional to height, unless sufficient space be allotted for a yard, unless the lower story be efficiently drained, unless the roofs and chimneys be properly and safely constructed, and unless every habitable room be of a certain height. These provisions are placed under the supervision of the District Surveyor. Such a Bill for Dublin, on a very comprehensive scale, was prepared in 1863 with the aid of our Borough Engineer, but was never introduced. That it is required, a single example out of hundreds of ill-constructed, unimprovable buildings will show.

In Stephen's-place, which leads from Upper to Lower Mount-street, the houses are built back to back, without any thorough airing, yard, or privy; filth must be therefore cast on the roadway. The clergymen and inhabitants of that aristocratic neighbourhood have justly complained, but the remedy is not easy. The placing of a water closet, which the poor would soon disarrange, is not safe in an unaired house; and, as the houses are owned by different persons, the Corporation can scarcely require that one shall be converted into a privy for the use of the occupiers of all the others, as we have done where one person owns several cottages. In other houses without yards or accommodation, filth has been accumulated to a vast extent in the cellars or back kitchen.

The Local Government Act is most useful with regard to new buildings, but does not interfere with those already erected, no matter how unwholesome, so that this addition would be desirable if the Act is extended to Ireland.

In Glasgow many of the courts and houses are very ill-constructed, and so overcrowded are they as to allow but the average of three square yards to each person. A bill, however, for improvement, with compulsory power, has passed unopposed through Committee, by which the ratepayers consent to tax themselves at 6*d.* in the £1 for five years, and 3*d.* for the ensuing ten years. It is provided that the improvements shall not go on so fast as to render houseless the present occupants, but that reconstruction shall go on *pari passu* with demolition. In Liverpool, under the Sanitary Amendment Act, 226 houses in 189 courts were removed or altered during last year. As many other great sanitary improvements have been achieved, the only circumstances which seem to account for the still excessive death rate of that city is the extreme condensation of its population.

There should be also some efficient controlling authority for the laying out of towns and streets. While the rectangular form, with due regard to meteorological circumstances, so common in American cities, is most healthful, our towns, as will be seen from these Ordnance Index Maps, consist of angular streets of such devious courses as to appear rather the result of chance than design, and blind courts, which are most insalubrious. As yet, scarcely any town in Ireland can boast of a wide street planted with trees.

In France the dwellings of the operative classes, as well as all other sanitary matters, are directed by a special branch of the State, named "Commission de Salubrité Publique;" and a most effective machinery is organized, to see that all houses are built on proper plans, and are preserved in good order.

Some very conclusive arguments have been put forward that Public Health Committees of the Privy Councils of these kingdoms should be charged with the control of town authorities, as the Poor Law Boards are with that of the local guardians. As precautions are often neglected during freedom from epidemics, inspection is then needed to a greater degree than even when they are among us. But in many places it is only when the selfish fear of contagion creates a panic, or when the pestilence has already invaded, that active measures are taken, and in the latter case their usefulness is very doubtful.

I will sum up in a very few words what I hope for as necessary to improve the dwellings of the poor, and thereby raise immensely the standard of public health:—

1st. The constitution of a central controlling authority for local government and sanitary improvement.

2nd. The enactment of a comprehensive building code: the passing of local acts, being expensive, is often avoided.

3rd. That our sanitary laws should be compulsory in cases of flagrant neglect: the permission to act is now very generally construed as permission not to act.

4th. A generally diffused desire on the part of employers and land owners to provide for the healthful wants of their dependents; and this will grow according as our nation prospers, and according as the masses are educated in the knowledge of the laws which regulate the well-being of their own bodies.

That the subject I have thus imperfectly submitted to you is closely connected with our prosperity, cannot be more forcibly expressed than in the words of the Devon Commissioners, which are painted in large letters over the entrance of our Agricultural Museum:—"While the dwellings of the general body of the people are surrounded by the elements of disease, and are damp, cold, dirty, and comfortless within, so long will the country be destitute of even the semblance of general prosperity."

HENRY MACLEAN, M. R. D. S., highly approved of the suggestions contained in Dr. Mapother's valuable paper. He read a paragraph from the Report of the Corporation of Dublin on the dwellings of the poor in the city, and also from a Memorial of the Dispensary Medical Officers, in which their lamentable condition was fully set forth, and the necessity for putting in force the by-laws on the subject strongly shown. He said the Corporation experienced the greatest opposition from the lodging house keepers in enforcing the observance of these by-laws.

MR. WILLIAM DALY, having obtained the permission of the Chairman to address the meeting, said that Dr. Mapother had stated to the meeting the position of this important public question, and had offered several valuable suggestions respecting it. The subject had so far engaged the attention of capitalists, that measures were being taken to provide the poor with a better class of dwellings. It was to be hoped that the Corporation would not relax their efforts to put in force the code of by-laws for the improvement of the dwellings of the poor.

MR. R. H. JEPHSON (with permission) stated that the lamentable condition of the house accommodation for the poor was to be attributed to the fact that houses were not built as the population extends. He spoke of the inability of Government to provide improved dwellings, but dwelt on the good that would be effected by the establishment of building societies.

MR. BEGGS (of London), by permission of the Chairman, stated that he fully endorsed, as regards the London population, all that Dr. Mapother had stated in his paper as to overcrowding in lodging houses in Dublin. He contended that it would be impossible to preserve the morals of a community if the ordinary rules of decency were not observed; in the present condition of the poorer lodging houses in London such was impossible. The greatest difficulty was experienced in London in remedying some of the evils complained of, owing to the number of separate jurisdictions. He mentioned that in one district in London there were no less than sixty-seven bodies having separate authorities and powers. Mr. Beggs then referred to the measures which had been introduced into Parliament with reference to this question. He believed Mr. Torrens' bill was conceived in the best spirit; but he considered that it would be found inoperative, in consequence of its conferring the power of carrying its provisions into effect upon the municipal bodies. Lord Shaftsbury's bill could not be carried out. Mr. Charles Ruxton's bill seemed to him to be the best: he aims to carry out the improvements in the dwellings of the poor by means of public companies. All that was necessary under that measure was proof that in any particular district a large number of houses were uninhabitable, and that the labouring classes were insufficiently provided with dwellings. Upon these facts being verified to the Secretary of State, he was empowered, upon receiving guarantees, to give loans to companies to erect new blocks of buildings. Mr. Beggs stated that such buildings had not been pecuniarily successful in London, but on perfectly explicable grounds—the expense of the site chiefly preventing them from being profitable speculations. He stated that the Building Societies, so called, are chiefly banks: as none of these societies have power to build, they sell and buy by means of trustees. Under all these circumstances, nothing was to be expected from philanthropy, as it was powerless to deal with such a matter; and under any circumstances it is well to remember that the lowest class of the poor is not provided for in any measure.

MR. MAPOTHER, C. E., of the United States (by permission), referred to some plans, which he exhibited, for the erection of labourers' dwellings. The same difficulties beset this question in the larger towns in America as in the United Kingdom.

MR. NUGENT ROBINSON, MR. JAMES DILLON, and MR. CARRUTHERS, having, by permission, addressed the meeting,

The CHAIRMAN stated that he had provided a building for the accommodation of the labouring classes which he considered successful. Two rooms were provided at 1*s.* 6*d.* per week; ventilation was well attended to, and overcrowding was prevented. He found it most difficult to enforce habits of cleanliness.

DR. MAPOTHER having replied, the meeting separated.

VI.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Agriculture (MM. les Inspecteurs Generaux de l'), Description des Espèces Bovine, Ovine, et Porcine de la France. . . . Tome I.—Espèces Bovine. 4to. *Paris,* 1857

THE AUTHOR.

Alani (Henr.), in Sallustii Catilinam et Jugurtham curæ secundæ. Insunt varietates. . . . . Codd. MS. trium. [Only 100 copies printed.] 8vo. *Dublin,* 1865

Alanus (Henr.), *Hannibal;* sive Disputatio, qua id agitur, ut Summus ille Pœnorum Imperator contra criminationes quasdam *T. Livii* Defensus detur. Nunc iterum edita auctior. . . . 12mo. *Dublinii: Londini, item Edinæ,* 1866

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Barral (J. A., Directeur du Journal d'Agriculture pratique, ...). Le Blé et le Pain, liberté de la boulangerie. 12mo. *Paris,* 1863

THE AUTHOR.

Belcher (T. W., M. D., Dub.; . . . .). Memoir of Sir Patrick Dun (Knt.) M. D.; M. P.; Physician General to the Army; . . . . . including important Records concerning the Profession of Physic in Ireland, ... Second Edition. 8vo. *Dublin,* 1866

THE AUTHOR.

Brady (Cheyne, Esq., M. R. I. A., ...). The History of the Hospital for Incurables. 12mo. *Dublin,* 1865

Brady (Cheyne, Esq., M. R. I. A., ...). The History of Steevens's Hospital. 12mo. *Dublin,* 1865

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (by John Herbert Orpen, Esq., LL. D., Local Treasurer, Dublin.)

British Association for the Advancement of Science; Report of the Thirty-fifth Meeting, held at Birmingham, in September, 1865. 8vo. *London,* 1866

THE AUTHOR.

Brodigan (F., Esq., Barrister-at-Law, ...). Parliamentary Reform Bill, 1866.—Letter . . . . to . . . . Earl Russell. 8vo. *London,* 1866

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Carrière (E.—A., ...). Encyclopédie Horticole. 12mo. *Paris, s. a.*

Carrière (E.–A., ...). Refutation de divers Articles de M. le Dr. J. *Guyot,* contre le Système de M. Daniel *Hooïbrenk* sur la Culture de la Vigne . . . . 8vo. *Paris, s. a.*

THE ASTRONOMER ROYAL, GREENWICH.

Catalogue of 7385 Stars . . . . Prepared from Observations made . . . . at the Observatory at Paramatta, New South Wales . . . . By Mr. William Richardson, of the Royal Observatory, Greenwich. 4to. *London,* 1835

THE AUTHOR.

Collins (John, Author of the "Fall of Man."). Two Essays on Constitutional Reform.

I. The Aspect of Society.
II. Office, and the Competitive System.

8vo. *London,* 1859

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Concours Agricole Universel de 1856.—Catalogue des Animaux, Machines, Instruments, et Produits exposés. 8vo. *Paris,* 1856

Concours d'Animaux de Boucherie, [a Bourdeaux, Lille, Lyon, Nantes, Nimes, et Poissy, depuis 1844.] Comte rendu des operations . . . et du rendement des Animaux primés. 13 tomes, 8vo. *Paris, v. a.,* 1849–1863

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Concours d'Animaux Reproducteurs Mâles, d'Instruments . . . . . . et Produits de l'Agriculture . . . . tenu a Versailles, ... 1850.
8vo. *Paris,* 1851

Concours [réginaux, nationaux ou universels] *d'Animaux Reproducteurs, d'Instruments, et des Produits Agricoles,* tenus à Agen, Alençon, Amiens, Angers, Arras, Auch, Aurillac, Avignon, Bar-le-duc, Beauvais, Besançon, Blois, Bourges, Caen, Cahors, Chartres, Chateauroux, Chamont, Clermont, Dijon, Epinal, Evreux, Grenoble, Gueret, Laval, Le Mans, Limoges, Maçon, Melun, Mende, Montauban, Montbrison, Mont-de-Marsan, Moulins, Nancy, Napoleon-Vendée, Nevers, Niort, Orleans, Paris, Pau, Perigeux, Privas, Rennes, Rodez, Rouen, Saint-Brieuc, Saint-Lo, Saint-Quentin, Toulouse, Tours, Tulle, Valence, Valenciennes, Versailles, Vesoul, en 1851,-52,-53,-54,-55,-56,-57-58, 60.
10 tomes gr. 8vo. *Paris, v. a.* 1851, 2, 3, 5, 6, 7, 9, 63

Crédit Foncier et Agricole, Des Institutions de, dans les divers Etats de l'Europe. Recueillis par ordre de M. *Dumas* . . . . et publiés par M. J. B. *Jousseau* . . . . . avec la collaboration de MM. H. de *Chonski* et *Delaroy.* 8vo. *Paris,* 1851

Crédit Foncier. Rapport a M. le Président de la République par M. *Dumas,* . . . . suivi d'un Rapport . . . . par M. J. B. *Josseau,* avocat, ... 8vo. [*Paris,* 1851]

THE AUTHOR.

Davy (John, M. D., F. R. S., &c.). On the Bursa Fabricii [from the Proceedings of the Royal Society, Vol. XV., 1866.]
8vo. *s. l.* [1866]

Davy (John, M. D. . . .). Observations on Meat (Butcher's Meat), ... the Changes to which it is liable under different circumstances . . . . 8vo. *s. l., s. a.* [1866]

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Doyere (M. L., ...). Conservation des Grains par l'Ensilage,
8vo. *Paris,* 1862

JOHN CUMMING, ESQ., HON. SEC. GEOLOGISTS' ASSOCIATION.

Geological and Natural History Repertory; . . . . . and Journal of *Pre-historic Archæology and Ethnology.* Nos. 10, 11, 12. Edited by *S. J. Mackie,* F. G. S., F. S. A., etc. *London,* 1866

THE GOVERNMENT OF CANADA, BY THE HON. W. M'DOUGALL, PROV. SEC.

Geological Survey of Canada. Report of Progress from its Commencement to 1863.—Atlas of Map and Sections. . . . . Officers of the Survey: Sir William E. *Logan,* . . . . Director. Alexander

Murray, Esq., Assistant Geologist. T. Sterry *Hunt*, LL. D., F.R.S., Chemist and Mineralogist. E. *Billings*, F. G. S., Palæontologist. 8vo. *Montreal*, 1865

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Gloger (C.-W.-L., de Berlin, ...). De la Nécessité de protéger les Animaux utiles . . . . ., les dégats causés par les Souris et par les Insectes . . . . Seconde Édition. 12mo. *Berlin*, 1863

Gourcy (le Comte Conrad de). Voyage Agricole en France, Allemagne, Bohème, Belgique. 8vo. *Paris*, 1861

Gourcy (Le Comte Conrad de). Voyage Agricole en Normandie dans la Mayenne, en Bretagne, dans l'Anjou, la Touraine, le Berri, la Sologne, et le Beauvoisis. 8vo. *Paris*, 1862

THE AUTHORS.

Grimshaw (Thomas Wrigley, A. B., M. B., ...). Thermometric Observations on Fever. 8vo. *Dublin*, 1866

Grimshaw (Thomas Wrigley, A. B.; M. B.; C. M.; L. R. C. S. I. . .). On Atmospheric Conditions influencing . . . . Typhus Fever. [Reprinted from Dub. Quart. Journ. Med. Science, May, 1866.]

Haast (Julius, Ph. D., F. G. S., F. L. S., etc. . . .). Report of the Geological Exploration of the West Coast. Folio. *Christchurch* [*Canterbury, New Zealand*], 1865

Haast (Julius, K. F. J. I. . . ., Provincial Geologist). Report on the Headwaters of the River Waitaki. Folio. *Christchurch, s. a.* [1865]

Halliwell (James O., Esq., F. R. S.). An Historical Account of New Place, Statford-upon-Avon, the last Residence of Shakespeare. Folio. *London*, 1864

Hardinge (W. H., M. R. I. A., ...). On the Irish Transplantation of 1653–54, and . . . . the Lands forfeited in Ireland at that Period. . . . 4to. *Dublin*, 1866

Hardinge (W. H., Esq.). Observations on an Unpublished Essay on Ireland, by Sir W. *Petty*. (A. D. 1687.) [From the Transactions of the Royal Irish Academy.] . . . . . 4to. *Dublin*, 1866

MRS. HARGREAVE.

Hargreave (the late Charles James, LL. D., F. R. S., a Judge of the Landed Estates Court, Ireland). An Essay on the Resolution of Algebraic Equations. Printed for Private Circulation. 8vo. *Dublin*, 1866

THE AUTHOR.

Henchy (John, ...). Ireland; its . . . . . Condition since . . . . . 1815: . . . . Measures . . . . for its Improvement. 8vo. *Dublin*, 1865

M. Béhic, Ministre de l'Agriculture, du Commerce, et des Travaux publics.

Heuzé (Gustave, ...). L'Agriculture de l'Italie Septentrionale.—Rapport a . . . . M. Armand Béhig, Ministre d'Agriculture . . . . 8vo. *Paris*, 1864

Industrie Linière.—Rapport a M. Dumas, Ministre de l'Agriculture et du Commerce, par Théodore *Mâreau*, Membre de l'Assemblée nationale pour le départment de la Vendée. Tome Premier. 8vo. *Paris*, 1851

The Rev. Beaver H. Blacker, A. M., Booterstown.

Inquiry . . . . into the Use and Import of *Eucharistic Symbols.* [*By* Alexander Knox. *See Notes and Queries*, 3rd *Ser.* ix., 195, 288, 361.] 8vo. *Dublin*, 1824

The Editor, E. Harvey Wadge, F. G. S., Stradbrook Hall, Blackrock.

Irish Industrial Magazine. January, 1866. No. 1.

The Author.

Kinahan (G. Henry, ...). Notes on the Foliation in the Gneiss and Schist of Yar-Connaught. . . . [Read before the Royal Geological Society of Ireland, January 10, 1866.]

M. Béhic, Ministre de l'Agriculture, du Commerce, et des Travaux publics.

Lavergne (M. L. de, ...). L'Agriculture et la Population. 2e édition. . . . 12mo. *Paris*, 1865

James Haughton, Esq., J. P.

Lees (Dr. F. R., F. S. A., Edin., ...). An Inquiry into the . . . . Results of . . . . Intoxicating Liquors in the Practice of Medicine. 8vo. *London*, 1866

M. Béhic, Ministre de l'Agriculture, du Commerce, et des Travaux publics.

Lefebvre-Ste-Marie (M. G., Inspecteur Général de l'Agriculture). De la Race Bovine courte corne améliorée dite Race de Durham. . . . 8vo. *Paris*, 1849

The Royal Bavarian Academy of Sciences, Munich.

Liebig (Justus von, Borstand der k. Akademie des Wissenschaften). Induction und Deduction. 8vo. *Munchen*, 1855

M. Béhic, Ministre de l'Agriculture, du Commerce, et des Travaux publics.

Liron D'Airoles (M. J. de). Notice Pomologique.—Description . . . . succincte de quelque Fruits inédits, ... Avec figures. 8vo.
Tome Ier, 1er, 2e, 3e, et 4e, livraisons, *Nantes*, 1858
Tome II. [10e, 11e, 16e, et 17e livraisons], *Nantes*, 1859

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Liron D'Airoles (M. J. de). Notices Pomologiques.—Liste . . . . . . des diverses Variétés du Poirier, anciennes, modernes et nouvelles. 8vo.

Tome I., ... *Nantes*, 1859
Tome II., ... *Nantes*, 1862
Tome III., 24ᵉ et 25ᵉ Livraisons, *Nantes*, 1862

THE AUTHOR.

M'Evoy (John). A Free Enquiry into the Irish Education Question. . . . . 8vo. *Dublin*, 1866

—— MATHEWS, T. C.

Madden (Peter). Lunar Denudation in connexion with the Noachian Deluge: A Theory. 8vo. *Dublin*, 1860

THE AUTHORS.

Mallet (Robert, M. A., F. R. S., M. R. I. A., President, 1866–67). *Institution of Civil Engineers of Ireland.*—President's Address; extracted . . . from the Transactions . . . . Vol. VIII. 8vo. *Dublin*, 1866

Mapother (E. D., M. D., ...). The Unhealthiness of Irish Towns, and the Want of Sanitary Legislation. 8vo. *Dublin*, 1866

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Ministère de l'Agriculture, du Commerce, et des Travaux publics. Commission des Engrais.—Rapports et Documents. 4to. *Paris*, 1864

THE ROYAL BAVARIAN ACADEMY OF SCIENCES, MUNICH.

Nageli (Dr. Karl., ...). Entstehung und Begriff der Naturistorischen Art. Zweite Auflage.

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

MR. W. E. HAMILTON.

North British Review. No. XXXIX. 8vo. *Edinburgh*, 1866

THE LORDS COMMISSIONERS OF THE ADMIRALTY.

Observations (Astronomical, Magnetical, and Meteorological) made at the Royal Observatory, Greenwich, in the Year 1863: under the Direction of George Biddell *Airy*, Esq., M. A., Astronomer Royal. . . . . 4to. *London*, 1865

THE AUTHOR.

Parkhurst (R. M., LL. D.) Local Courts and Tribunals of Commerce. . . . . 8vo. *Manchester*, 1866

THE COMMISSIONERS OF PATENTS.

Patents for Inventions.—Abridgments of Specifications relating to Oils, ...; Lubricants, Candles, Soap. A. D. 1617–1863. 8vo. *London*, 1865

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Pouriau (A.-F., ...). Eléments de Sciences Physiques appliquées a l'Agriculture. Chemie Organique . . . . 12mo. *Paris*, 1864

Practique de la Fabrication du *Fromage*, façon Hollande, a l'établissement agricole de Saint-Angeau (Cantal). 12mo. *Paris*, 1862

THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA.

Proceedings of the Academy of Natural Sciences of Philadelphia.
1864. 8vo. *Philadelphia*, 1864
1865. 8vo. *Philadelphia*, 1865

THE AMERICAN PHILOSOPHICAL SOCIETY.

Proceedings of the American Philosophical Society. Vol. X., No. 73. 8vo. *Philadelphia*, 1855

THE SECRETARY OF THE INSTITUTION OF MECHANICAL ENGINEERS [BIRMINGHAM].

Proceedings of the Institution of Mechanical Engineers, 1st and 2nd August, 1865. Part I. 8vo. *Birmingham* [1865]

THE AUTHOR.

Ramadge (Francis H., M. D., Oxon. . . . .). The Curability of Consumption: . . . . Fifteenth Thousand. 8vo. *London*, 1861

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Rapport Général . . . pour l'étude du la Péripneumonie Épizootique du Gros Bétail; rédigé par M. H. *Bouley* . . . . 8vo. *Paris*, 1854

Rapport a l'Empereur sur l'Agriculture [par Armand *Béhic*]. 8vo. *Paris*, 1864

Rapport sur l'Industrie Linière, par M. Theodore *Mâreau*, Ancien Représentant. Tome deuxième. 8vo. *Paris*, 1859

THE EDITOR.

Register of the King and Queen's College of Physicians in Ireland, with Historical Introduction: . . . . . a Roll . . . . from 1654 to 1864; An Obituary . . . . from 1692 to 1866, ..., etc. 8vo. *Dublin*, 1866

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Renault (M. Directeur de l'Ecole veterinaire d'Alfort). Typhus Contagieux du Gros Bétail . . . . pestis bovina . . . . Rinderpest. 8vo. *Paris*, 1866

Renault (M. Directeur du l'Ecole impériale veterinaire d'Alfort . .). Typhus Contagieux des Bêtes Bovines . . . . 8vo. *Paris*, 1860

THE AUTHOR.

Report (Second) upon the River Waimakariri and the Lower Plains of Canterbury, New Zealand. By W. T. *Doyne*, M. Inst. C. E. . . .
Folio. *Christchurch*, 1865

THE MUSEUM OF COMPARATIVE ZOÖLOGY, BOSTON, MASSACHUSETTS.

. . . . *Report* of the Trustees of the Museum of Comparative Zoölogy . . . . Report of the Director. 1863. 8vo. *Boston*, 1864

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DES TRAVAUX PUBLICS.

Rieffel (Jules, Directeur de l'École impériale de Grand-Jouan, ...). Manuel du Propriétaire de Métairies principalement dans l'ouest de la France ;— 12mo. *Paris*, *s. a.*

Romieu (Madame (Marie Sincere)). Des Paysans et de l'Agriculture en France au XIX^e Siècle. Interêts.—Mœurs,-Institutions.
8vo. *Paris*, 1865

THE AUTHORS.

Ryan (Matthew, of County Tipperary, Ireland, ...). The Celebrated Theory of Parallels. Demonstration of the Celebrated Theorem, Euclid I., Axiom 12. 8vo. *Washington*, 1860

Sankey (Wm. H. Villiers, Esq., Civil Engineer, ...). Railway Reform. . . . Security of Life, and . . . . of Capital.
8vo. *London*, 1866

THE UNIVERSITY OF KIEL.

Schriften der Universität zu Kiel. Aus dem Jahre 1864. Band XI.
4to. *Kiel*, 1865
Aus dem Jahre 1865. Band XII. 4to. *Kiel*, 1866

M. BÉHIC, MINISTRE DE L'AGRICULTURE, DU COMMERCE, ET DE TRAVAUX PUBLICS.

Tisserand (M. Eugène . . .). Etudes Economiques sur le Danemark, le Holstein et le Slesvig. 4to. *Paris*, 1865

THE ACADEMY OF SCIENCE OF ST. LOUIS, STATE OF MISSOURI, U. S. A.

Transactions of the Academy of Science of St. Louis. 8vo.
Vol. I. 1856–60. . . . ., No. 3. *St. Louis*, 1859
No. 4. *St. Louis*, 1860
Vol. II. 1860 . . . ., No. 1. *St. Louis*, 1863

THE ROYAL SOCIETY OF SCIENCE AT UPSAL.

Transactions. Nova Acta Regiæ Societatis Scientiarum Upsaliensis. Seriei Tertiæ. Vol. V. Fasc. II.

THE PATHOLOGICAL SOCIETY OF LONDON.

Transactions of the Pathological Society of London, Volume the Sixteenth . . . . Session 1864–65. 8vo. *London*, 1865

THE PHILOLOGICAL SOCIETY.

Transactions of the Philological Society, 1865. See *Wheatley* (Henry B.) 8vo. *London* and *Berlin*, 1866

Wheatley (Henry B.). A Dictionary of Reduplicated Words in the English Language. (Appendix to the Transactions of the Philological Society for 1865.) 8vo. *London* and *Berlin,* 1866

M. Béhic, Ministre de l'Agriculture, du Commerce, et des Travaux publics.

Vaillant (le Maréchal . . . .). . . . . . Rapport a . . . . . la Ministre de l'Agriculture . . . . Première Partie. Fecondation artificièlle des Céréales. Folio. *Paris,* 1865

Yvart (A., Inspecteur . . . . des Bergeries Nationales). Études sur la race Mérinos a laine Soyeuse de Maucham. 8vo. *s. l., s. a.*

(Signed) Edw. Richards Purefoy Colles,
Librarian.

Sept. 30, 1866.

BOTANIC GARDEN.

Miss Waller, *Rostright Rectory, Enniscorthy*:—Parcel of Seeds of various kinds, mixed, from Australia.

Meadows Taylor, Esq., *Old Court, Harold's Cross*:—15 parcels of Indian Seeds, sent by Captain Allardyce.

M. Louis van Houtte, *Horticulturist, Ghent, Belgium*:—15 exceedingly rare and valuable Plants.

Right Hon. Lord Sligo, *Co. Mayo,* through the Hon. Major Hay:—Mixed parcel of Tropical Seeds.

Dr. J. Barret Kearney, *Gofton Hall, Finglas*:—Seeds of various kinds, from West Indies, for Museum.

Robert Mallet, Esq., 12, *Bridge-street, Westminster, London*:—Parcel of Tree Fern Seeds, from New Zealand, and some other kinds of Seeds.

Mr. Miln, *Old Calabar*:—Box of Seeds and Palms, &c.; also Specimens of dried Plants, &c.

Mr. Tyerman, *Curator, Botanic Garden, Liverpool*:—Hamperful of Pelargonium Cuttings.

Ditto:—11 Rare Plants.

The Curator, *Botanic Garden, Manchester*:—19 Species of rare Plants.

Mr. Ewing, *Curator, Botanic Garden, Sheffield*:—11 Species of rare Plants.

Captain Dixon Vigors, through J. Cliff Vigors, Esq., *Leighlin Bridge, Carlow,* through Dr. Carte:—Large parcel of mixed Seeds, from Burmah, E. I.

Thomas Glover, Esq., *Smedly Hill, near Manchester*:—Hamperful of Hardy Ferns, from Westmoreland.

Mr. Tyerman, *Curator, Botanic Garden, Liverpool*:—129 species of Herbaceous Plants.

Messrs. Stansfield, *Nurserymen, Todmorden, Lancashire*:—7 Species of rare Ferns.

C. W. Hamilton, Esq., M. R. D. S.:—150 Plants of bedding-out Pelargoniums.

Miss Hamilton, *Nicaragua*:—Some specimens of Woods, for Museum.

Ditto:—Parcel of mixed Seeds.

Dr. Harvey, T. C. D., sent by Mrs. Barber, of *Natal*:—15 kinds of Seeds, and two rare Plants.

Mr. Bull, *Nurseryman, King's-road, Chelsea*:—19 rare Plants.

Edward Leeds, Esq., *Longford Bridge, near Manchester*:—32 species of rare Herbaceous Plants.

James Morris, Esq., 8, *Theresa-terrace, Hammersmith, W., near London, Commissioner of Mauritius Department, International Exhibition*:—Fine Collection of Fibres, made from Plants grown at the Mauritius. Exhibited by Professor Bouton, and prepared by Mr. Duncan.

Ditto, Ditto:—Fine Collection of half-prepared Medicinal Plants, exhibited by Professor Bouton, noticed in his work, "Les Plantes Medicinales de Maurice;" Plait made from leaves of double Cocoa Nut (*Phænocophorum Sechellyarum*).

Messrs. Backhouse, *Nurserymen, York*:—28 Species of rare and valuable Plants.

From International Exhibition, through Royal Dublin Society:—Box filled with Casts of Fruits, &c.

J. Hope, Esq.:—23 kinds of Australian Seeds.

J. M'Nab, Esq., *Royal Botanic Garden, Edinburgh*:—Seeds of *Raphanus caudatus*.

Herr Max Leichtlin, *Carlsruhe, Baden*:—3 parcels of Seeds and rare Plants.

N. B. Ward, Esq., *The Ferns, Clapham Rise, London, S.*:—20 kinds of Seeds of Alpine Plants.

Professor Martius, *Botanic Garden, Montpelier, France*:—96 parcels of Seeds.

Herr Otto, *Inspector, Botanic Garden, Hamburgh*:—67 papers of Seeds.

George Dunn, Esq., *Dartry*:—1 parcel of Australian Seeds.

Dr. Caspray, *Director of Botanic Garden, Konigsberg, Prussia*:—71 parcels of Seeds.

(Signed) D. Moore, *Director*.

NATURAL HISTORY MUSEUM.

George Henry Kinahan, Esq., Geological Survey of Ireland:—A specimen of Native Sulphur in Limestone, from the Co. Galway; a number of Mineral Specimens from Outerard, Co. Galway.

William Corbett, Esq., *Castleconnell, Co. Limerick*:—A Chinese Pheasant (*Phasianus torquatus*), male; and a Partridge-breasted Grosbeak (*Amadina erythrocephala*, Smith); a Short-eared Owl (*Strix brachyotos*); and 2 Fossil Shells (*Spirifer striatus*, and *Bellerophon apertus*); a specimen of Bauer's Parrakeet (*Platycercus Baueri*), Port Lincoln, Australia; a Rufous-necked Weaver Bird (*Ploceus textor*), Africa; a King Lory (*Aprosmictus scapulatus*), Australia.

Frederick J. Foot, Esq., Geological Survey of Ireland, *Boyle, Co. Roscommon*:—14 specimens of Native Birds; a Wasp's Nest; and a few Insects, from Coblentz.

William Thornhill, Esq., M. B., F. R. C. S. I., 44, *Gardiner-street, Lower*:—A Dipper (*Cinclus aquaticus*), young male, shot at Dundrum.

Dr. Anderberg, *Stockholm*:—5 specimens of rare Minerals.

Dr. T. Sterry Hunt, F. R. S., *Montreal*:—Specimens of Canadian Serpentine.

Richard Williams, Esq., 38, *Dame-street*:—A Bernicle Gosling (*Bernicla leucopsis*).

Captain Hutton, 8, *Waterloo-road*:—A few specimens of *Amphipepla involuta*, from Killarney.

Lord George Hill, *Ramelton, Co. Donegal*:—A Cuttle Fish (*Loligo vulgaris*).

Captain Close, 45th Regiment, *Parkhurst, Isle of Wight*:—The Skull of a Wart Hog (*Phacochœrus Pallasii*); 2 sets of Horns of the Duyk-bok (*Cephalophus grimmia*); 2 sets of Horns of the Ouribi (*Scopophorus ouribi*); and 2 sets of Horns of the Riet-bok (*Eleotragus arundinaceus*), all from Natal, S. E. Africa.

Rev. Samuel Haughton, M. D., *Trinity College*:—A Collection of Rocks from Norway; a Collection of Arctic Rocks and Specimens brought home by Sir F. L. M'Clintock, R. N.

Right Hon. The Marquis of Kildare, *Carton, Co. Kildare*:—A Pig's Skull (*Sus scrofa*), found near Maynooth.

Messrs. J. Powell and Sons, *Whitefriars' Glass Works, London, E. C.*:—4 Glass Jars, with Stoppers; 2 Glass Stands with Covers; and 3 Glass Tubes.

Rev. Dr. Comerford, V. G., *Mauritius*, per P. O'Meara, Esq., M. R. D. S., *Aden*:—3 Leg Bones (*Tibiæ*), and a small portion of the Lower Mandible of the Dodo (*Didus ineptus*), from Mahebourg, Mauritius.

Lord Viscount Powerscourt, *Powerscourt House, Enniskerry*:—An imperfect Skeleton of a large Indian Elephant (*Elephas Indicus*).

Joseph H. Lamprey, Esq., *Birr Observatory, Parsonstown, King's Co.*:—A specimen of a Hawfinch (*Coccothraustes vulgaris*), shot at Parsonstown.

Robert Warren, Esq., Jun., *Moyview, Ballina, Co. Mayo*:—A specimen of the Iceland Gull (*Larus Islandicus*), young male; and a young *Larus ridibundus*; a Black-backed Gull (*Larus marinus*); 2 immature ditto; 1 Common Gull (*Larus canus*); and 1 Black-headed Gull (*Larus ridibundus*).

Major-General O'Connor, Commander in Chief, *Jamaica*:—An Ethnological Collection from Sierra Leone, Africa.

Commodore Sir F. Leopold M‘Clintock, R. N., *Kingston, Jamaica*:—A Collection of Fish (Crustacea, Echinoderms), &c., &c., from Barbadoes; a fine specimen of *Fistularia tabaccaria*, Jamaica; a Collection of Fish, from Jamaica.

Dr. J. Lauder Lindsay, *Gilgal House, Perth*, per Rev. Samuel Haughton, M. D.:—A Collection of Rock specimens from New Zealand.

Major-General Cunynghame, C. B., &c., &c., *Royal Barracks*:—A glass Lachrymatory; an earthenware Lachrymatory; a glass Bottle or Urn, broken; an earthenware Bottle—all taken from the tombs at Kertch, Crimea; and two pieces of Ornamental Stonework from a tomb near the Indus; 6 Grecian Coins, found at the city of Alexander, on the Indus.

Joseph Scott Moore, M. R. D. S., *Kilbride, Co. Wicklow*:—A specimen of Striped Agate in granite.

Henry Cunynghame, Esq., *Royal Barracks*:—A specimen of *Helops violaceus*.

William Acton, Esq., 16, *Fleet-street*:—4 Bird Skins, from Burmah.

James Henry, Esq., M. D., Surgeon R. N., *Albert Hotel, Harcourt-street*:—2 Crania—one of an Aboriginal Peruvian Inca, from the Mummy Grounds of Arica; the second, that of a young female Tahitian.

Captain A. F. Boxer, R. N., 5, *Alexandra Villas, Acton Vale, London, W.*:—2 Skins of the Napu Deer (*Tragulus Javanicus*); and a Chinese Pheasant (*Phasianus torquatus*), China.

Captain John Dunn, *Royal Hospital, Kilmainham*:—A Piping Crow-shrike (*Gymnorhina leuconota*), Australia.

His Grace The Duke of Leinster, *Carton, Maynooth*:—2 Cases of Chinese Insects.

The Very Rev. Dean of Clonfert, &c., &c., *Dublin Castle*:—The Horn of a *Bos longifrons?* found in a bog near Kenmare, Co. Kerry.

Sandford Palmer, Esq., *Ballinlough, Roscrea*:—A Sparrow Hawk (*Falco nisus*).

Alfred M'Clintock, Esq., M. D., 21, *Merrion-square, North*:—A Golden Oriole (*Oriolus galbula*), male, Gibraltar.

Miss Hamilton, *Nicaragua, Central America*:—A small Collection, including the ear bones of a Manatee; a Humming Bird's nest; 4 bottles of Snakes; a young Turtle; and a few Fish, &c., &c.

John Tuthill Bagot, Esq., *Australia*, through J. Metge Barry, Esq., M. D., M. R. D. S., 90, *Leeson-street, Lower*:—Casts of some of the Fossil Remains of the Diprotodon from Hargold, 400 miles north of Adelaide; a specimen of Native Salt, crystallized, from South Australia.

Hon. Skeffington Daly, *Kildare-street Club*:—A Variegated Pheasant.

Sir Dominic J. Corrigan, Bart., M. D., &c., &c., *Merrion-square*:—A fine specimen of the Spiny Lobster (*Palinurus vulgaris*), Dalkey Sound.

Mrs. R. J. O'Flaherty, *Newcastle, Jamaica, West Indies*:—2 specimens of the Nest of the Mygale.

John Good, Esq., M. R. D. S., 49 *and* 50, *City Quay*:—Skull of a Grampus (*Orca gladiator*), taken in a dredge off the coast of the Isle of Man.

(Signed) Alexander Carte, M. D., *Director*.

August, 1866.

AGRICULTURAL MUSEUM.

The Marquis of Kildare:—A Collection of Dried Plants indigenous to the County Kildare.

Right Hon. Earl of Leitrim, *Killadoon, Celbridge*:—A Hand Scutcher and Board, illustrative of the Belgium System of preparing Flax.

Alderman Mackey, J. P., *Dublin*:—Collection of Seeds to which the Special Prize Medal at the International Exhibition has been awarded.

G. P. Jervis, Esq., *Italian Delegate, Florence*:—Specimens of Gums, Seeds, &c. Fibres, and Models.

Andrew Corrigan, *Curator*.

FINE ARTS DEPARTMENT.

L. Gardie, *Sculptor, Bath*:—Bust, in Plaster, of Captain Speke.

INTELLIGENCE.

REPORT OF THE SCHOOL OF ART OF THE ROYAL DUBLIN SOCIETY FOR THE YEAR 1865.

In presenting the Report of the School of Art for the past year, it is gratifying to have again to speak of its continued prosperity, and the advancement of its Students, as evidenced by the marked success that has attended their efforts in the Medallion and Medal competitions, as well as in the Examinations for Prizes and Certificates of the second grade; results which will bear most favourable comparison with those of any previous year since the establishment of the institution.

During the year the number of Students in attendance in the Central School has been 480, showing an increase of 44 over the preceding year; 248 of these Students were males, and 237 females; the total number of Students attending the Artizan Classes has been 251,—the males amounting to 202, and the females to 49. Amongst these 251 Artizan Students were thirty-seven clerks, twenty-one teachers, fifteen artists, four architects, seven lithographers, four cabinetmakers, six upholsterers, four decorators, five ironmongers, six house painters, three builders, three carvers of stone, three wood carvers, three jewellers, two draughtsmen, four Art Teachers, and four photographers.

The income derived from fees amounted to £425, being an increase of *£*36 *5s.* 1*d.* over the receipts of 1864.

The maximum of attendance was in March, and was smallest during the month of July.

The number of pupils taught Drawing in Public and other Schools through the agency of the Central School has been 2485, showing an increase of 637 over the numbers under instruction in 1864. The fees paid on account of these pupils amount to £99.

The attendance and fees of the Students of the Central School, together with the numbers instructed in external Schools, and fees paid, as compared with the three previous years, may be seen in the following tabular statement:—

School of Art.

Year.	Number of Students.	Fees.		
1662,	330	£265	16	4
1863,	386	279	15	9
1864,	436	388	14	11
1865,	480	425	0	0

External Schools.

Year.	Number of Students.	Fees.		
1862,	640	£14	0	0
1863,	1348	41	0	0
1864,	1848	94	0	0
1865,	2485	99	0	0

The Department of Science and Art has allowed, on account of National Medallions and Local Medals, the sum of £46 in Water Colour Drawings, Casts, and other examples which have been supplied to the School. The Water Colour Drawings, thirteen in number, consist of examples by some of the most eminent Masters of the day, viz.: Edward Duncan, Frederick Taylor, Harding, Leitch, Bentley, Müller, Gobell, D'Egville, Mole, Rowbottom, and Collingwood Smith.

A study from the life, executed in the School by Miss Seymour, and exhibited at Alton Towers, was purchased by S. Grinders, Esq., of Ingestre, Stafford. Miss Seymour has presented the sum received to the School, in order that objects of still life may be obtained for the Painting Classes. The total receipts for the year may be more readily seen in the following Table :—

Fees of School of Art,	£425	0	0
,, Public Schools,	99	0	0
Allowance (in Examples) by Department of Science and Art,	46	0	0
Presented by Miss Seymour,	4	0	0
Total,	574	0	0

The Medallions and Medals to be distributed to-day have been won in competition, the Drawings having undergone a strict examination by Artists of eminence. Sketchy, flimsy execution, and mere prettiness being invariably discouraged, the standard of such Drawings has been raised from time to time by the Department, necessitating increased exertion, both on the part of Masters and Students. In order that works of sufficient excellence may be produced, severe training in elementary work is necessary.

The competition works, 113 in number, in Drawing, Painting, and Modelling, were examined in London, in March, when four National Medallions, thirty-two Local Medals, four Honourable Mentions in the National competition, and seven in the Local competition were gained. It may also be mentioned that twenty-nine Drawings were retained for the National competition, for which very excellent works only are selected, in order that they may compete with the best Drawings of the Art Schools of Great Britain. The number of similar works selected in 1864 was ten ; and in 1863, three.

The Jurors were Sir Charles Eastlake, P. R. A. ; J. C. Horsley, R. A. ; Richard Redgrave, R. A. ; Francis Fowke, Esq. ; and Henry Alexander Bowler, Esq.

The Examiners, in their Report upon the works of the Society's School, state—"that the various stages of instruction were well represented by the works sent up for competition. The progress noted last year has been so well maintained, that, subject to the sanction of the Department, the Examiners have awarded Medals, in excess of the number allowed by rule." We believe that, with the exception of Birmingham, a greater number of Medals has not been obtained in any former year by any School of Art ; whilst this year Dublin, with a population smaller than that of Birmingham or Glasgow, exceeds those towns, both with regard to Medallion and Medal awards.

Of the four works successful in this National Competition, three were original designs ; and the fourth, a Painting in Monochrome, viz. a Design for Furniture Poplin, by Henry Felix Thomas. This has been manufactured by Messrs. Fry and Co., of Westmoreland-street. The Wood Anemone, treated ornamentally, by William Henry Murray. A Design for Park Gates, by Henry Edward Hall. A Painting in Monochrome of a portion of the Architrave of the Gates of Ghiberti, by Frances Seymour.

The twenty-nine works selected for National Competition have recently been exhibited at Alton Towers, Staffordshire.

Those works of the Students that had been returned from London were on view in the School of Art in October, and were visited by 1333 persons ; and on the same occasion a selection from the Drawings made in the various external Schools in connexion with the Central Institution were also exhibited. Those Drawings generally were good, particularly those executed in the King's Hospital, Church Education Society's Schools, Ralph Macklin's, St. Werburghs's, St. Catherine's, and St. Michan's Schools.

Two Students of the School were successful at the competition for the Taylor Prizes, viz., Mr. F. Walker, and Miss K. Seymour.

The Silver and Bronze Medals of the Society were this year offered for studies from the life, in Oil Colours, Drawing from the Antique in Chalk, Anatomical Drawing, Original Designs for Manufactures, Modelling in Clay from the Antique, Architecture from actual measurement, Landscape from Nature, in Oil or Water Colour, Model Drawing, Perspective and Geometrical Drawing. Sixty-three works were submitted. The Judges appointed to examine them were—Sir George Hodson, Bart., Major-General Colomb, Thomas Alfred Jones, Esq., R. H. A. The adjudication took place on the 18th inst. Five First Silver Medals were awarded in the following subjects—Painting from the Life, Landscape painted from Nature, Original Design for Manufacture, Modelling in Clay from the Antique, Architectural Drawing; and a sixth was recommended for works Modelled in Clay from the life. Three Second Silver Medals, viz. for Drawing from the Antique a figure not less than two feet high, Drawing of Head, Hand, and Foot from the Antique and Anatomical Drawing. Two additional Second Silver Medals were recommended in Landscape and Original Design. The Honourable Mentions in the Silver Medal competition were five; viz., two in Painting from the Life, one in Anatomical Drawing, one in Landscape from Nature, and one for Original Design.

First Bronze Medals were gained as follows—one for Perspective Drawing, one for Models shaded in Chalk, and one for Geometrical Drawing; an additional First Bronze was recommended for Modelling in Clay from the Antique. Second Bronze Medals were recommended in Model Drawing and Geometry. The Honourable Mentions in the Bronze Medal competition were two, viz., in Model and Geometrical Drawing.

The Annual Examination took place on the 20th and two following days of June, and was conducted by the Art Inspector, Robert G. Wylde, Esq. It consisted of time exercises in Freehand Drawing, Geometry, Perspective, Drawing from Solid Objects and Models, Mechanical Drawing, and Memory Drawing. 85 Students of the School of Art presented themselves for Examination; and 72 succeeded in passing in 115 papers of the second grade, 70 of these exercises passing at the mark "excellent," and 45 at the mark "good;" in addition to which 4 Prizes and 8 Certificates were gained by Students of external schools taught through the agency of the Central School. One hour was allowed for each of the exercises, which are of a severe character, and demand real knowledge of the subject, and power of hand on the part of the Student. A paper marked "excellent," receives a prize; one marked "good," a Certificate. In some cases two, three, or more Prizes are included in one award.

470 pupils of Public Schools, connected with the Central Institution, were examined on the same occasion in papers of the first grade, out of which number 112 exercises obtained "excellent" and Prizes; and 170 papers were marked "good," and gained Certificates.

In June, Mr. Robert Walsh, Francis Walker, William H. Murray, and Edmund C. Byrne, were appointed Art Scholars by the Department, the three latter being reappointments.

One Student of the School has been admitted to the Training Class at South Kensington; and two others having satisfactorily executed the works required for the first Certificate of the third grade (or Art Masters' Certificate), presented themselves for examination at South Kensington in July last, and were successful in the whole of the subjects, excepting one—Architecture.

Many Students of both sexes have attended our Classes in order to qualify themselves to become Teachers of Art, either as a specialty, or as a part of general education; and many others have obtained advantageous employment, and are bringing their powers of Drawing to bear practically upon the Manufactures of the country.

The attendance of Artizans has steadily increased during the year, the numbers now being much greater than for many years past. And it is gratifying to find that such Students, for whose benefit and instruction the School of Art is more particularly intended, are availing themselves of those advantages offered by this Institution, viz., a knowledge of the practice of Art, the general conditions of its application to Manufacture, and the principles of taste, alike indispensable in all ornamental and elegant construction, whether in metal, wood, stone, or woven fabrics.

Doubtless it would be taking too narrow a view of the aims and objects of this Institution to limit its operations to any particular class, whether artizan or otherwise; by its operations the entire population is benefited, and the taste of the community improved.

The results for the year may be more readily seen by the following List:—

The Students successful in the Taylor Competition, ...	2
Do. do. in competition for National Medallions, . . .	4
Do. receiving Honourable Mention in National Competition, .	4
Carried forward,	10

Brought forward,	10
Students successful in competing for Society's Silver and Bronze Medals, ...	17
Do. receiving Honourable Mention in Do., ...	7
Do. successful in the Local Medal Competitions, ...	32
Do. receiving Honourable Mention in Local Medal Competition,	7
Number of Second Grade Prizes gained at Annual Examination for Papers marked Excellent, ...	74
Number of Second Grade Certificates for Exercises marked Good, .	53
Number of First Grade Prizes obtained by Pupils of External Schools taught Drawing by the School of Art, ...	112
Number of First Grade Certificates gained by Pupils of above Schools,	170
Number of Pupils of Public Schools to whom Department Prizes for Drawing on Slates have been awarded at Examinations held by the Art Master in the several Schools, ...	46
Total, ...	528
Corresponding number in 1864, ...	415
Do. in 1863, ...	112

The names of the Prize Students for the present year may be found in the Programme of Distribution.

By a recent Minute of the Privy Council on Education, the Prize List of the Department of Science and Art will include Ten Gold Medals, to be distributed as follows amongst all the Schools in the Kingdom:—

One Gold Medal for the best Study from the Antique in Chalk, in Monochrome, or Modelled.

One do. for Group of Still Life, painted from Nature in Oil or Water Colours.

One do. for the best Studies from the Life in Colour, Chalk, or Modelled.

Six do. for the best Designs in the three Classes—Architectural Design, Surface Design, Plastic Design.

One do. for a Work of a Class not included under the above-named heads.

Twenty Silver Medals, of which part will be given to the second best in the various subjects to which Gold Medals are assigned, and the rest to meritorious works in the same, or best works in other subjects of study.

Fifty Bronze Medals to meritorious works in any of the various subjects of study.

The Annual Examination will in future take place in the month of March; and the works of the Students executed in competition for the above Medals, &c., must be transmitted to the Department for inspection on or before the 20th of March.

(Signed) I. S. Adamson, Lieut.-Col.,
Chairman.

REPORT OF THE JUDGES OF THE TAYLOR PRIZE COMPETITION.

We, the Judges appointed to examine the Works offered in Competition for the Taylor Prizes, have much satisfaction in stating, for the information of the Trustees, that in the productions submitted to us on this occasion a very marked improvement is to be observed in character and execution, evincing on the part of the Students a careful observation of the rules of composition, and an attention to natural effects.

In No. 1—We recommend a Prize of £5 to be awarded to William Francis Farrell, for a Composition of Figures in Outline.

In No. 2—A Prize of £10 to Francis Walker, for a finished Drawing of "Narcissus at the Fountain."

In No. 3—We propose to augment the Prize offered in this Section, awarding £15 to Francis Walker, for his excellent "Study of Trees in Rathfarnham Park."

In No. 4—We award a Prize of £10 to Kate Seymour, for her "Study from Nature of a Group of Trees, in Water Colours."

Taking into consideration the marked artistic talent and attentive study displayed by Francis Walker, in his Works of Landscape and Figure Composition, the latter now exhibited being superior to his successful effort of last year, we think that the Trustees might with much propriety exercise their powers under Rule 3, by awarding a Scholarship of moderate amount to this promising young Student.

In conclusion, we are of opinion that the recommendation of the Judges in 1864, by which defined subjects of a simple character were offered for competition, has worked the good effect, and may with advantage be continued in the ensuing year.

(Signed) **George Hodson, Bart.**
Thos. A. Jones, R. H. A.
George Colomb, Major-General.

December 19, 1865.

Approved by the Trustees of the Will; and in compliance with the recommendation by the Judges, a Scholarship of £20 a year is awarded to Francis Walker, for two years, subject to the provisions of Rule 3.

December 12, 1856. C. E. Bagot.

In reporting upon the Works executed by the Students of the School in competition for the Society's Prizes, the Judges remark:—

"In making our Adjudication on the Works submitted for an inspection on the present occasion, we feel it our duty to remark, with great satisfaction, upon the manifest improvement which has taken place in the general character of the several productions of the Students in the various branches of design, a result which, in a great measure, may easily be attributed to the care, diligence, and able instruction imparted by the Head Master.

"While we have to observe with concern the absence of Competition in that very important branch of study, Drawing from the Antique, we are enabled to state with much confidence, that in the Department of Landscape there is conspicuous much careful attention to the observance of natural effects; we also think that great credit is due to the youthful Student, Mr. Watkins, to whom the Honorary Prizes have been so justly awarded in the Class of Modelling from Nature and the Antique, evincing, as he does, that patient and conscientious study so essential to future excellence.

"We have also been most favourably impressed with the character of the designs for carpet, poplin, and room paper manufacture, many of which in that important and truly practical department are remarkable for an attentive application of the laws of harmonious colouring, and hold out great promise of success in this highly useful branch of decorative Art.

(Signed) "George Hodson, Bart.
"Thos. A. Jones, R. H. A.
"George Colomb, Major-General.
"Robert Callwell."

MONDAY, NOVEMBER 20, 1865.

DR. MAPOTHER in the Chair.

MR. J. EMERSON REYNOLDS read a paper on Electrical Cohesion Figures, and exhibited by means of the lime light the figures produced by various substances which he had used.

PROFESSOR E. W. DAVY mentioned some very curious chemical changes he had observed in the bark and leaves of the *Populus tremula* and other poplars.

MONDAY, DECEMBER 18, 1865.

WILLIAM ANDREWS in the Chair.

MR. JOSEPH FISHER read a paper, entitled "The State of the People of those Countries in which Small Estates exist, particularly with reference to the Production of Food."

MONDAY, JANUARY 15, 1866.

THE HON. GEORGE HANDCOCK, V. P., in the Chair.

PROFESSOR DAVY described and exhibited Schebler's new and ingenious apparatus for the quick and easy estimation of Carbonic Acid under different circumstances.

MR. JOHN HOARE read his paper "On the Sea Fisheries of Ireland." (Published.)

WEDNESDAY, JANUARY 17, 1866.

WILLIAM ANDREWS in the Chair.

The discussion of Mr. Hoare's paper "On the Sea Fisheries of Ireland" was resumed.

MONDAY, FEBRUARY 10, 1866.

SIR EDWARD GROGAN, BART., in the Chair.

MR. WILLIAM ANDREWS read a paper "On the Herring Fisheries of Ireland." (Printed in the present Number.)

MONDAY, MARCH 19, 1866.

DR. DE RICCI in the Chair.

MR. THOMAS DILLON described a method of preparing Parchment for Title Deeds, so as to render the contents indelible.

The Model of a Flax-scutching Machine, the invention of Mr. JOHN EGAN, of Sligo, was exhibited.

MONDAY, APRIL 10, 1866.

DR. DE RICCI in the Chair.

DR. J. M. BARRY read a paper "On Submarine Earthquakes and Volcanoes." (Published.)

MONDAY, MAY 26, 1866.

DR. EVORY KENNEDY in the Chair

DR. MAPOTHER read a paper "On Labourers' Dwellings." Published).

APPENDIX.

◆

METEOROLOGICAL JOURNAL,

KEPT AT

The Royal Dublin Society's Botanic Garden, Glasnevin,

[HEIGHT ABOVE LEVEL OF SEA, 65 FEET.]

FROM

1st JULY, 1865.

JULY, 1865.

DATE.	BAROMETER.	THERMOMETER.					WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day. At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Saturday,	29·800	67	70	69	70	45	S. E.	10	Many,	Broken,	. .	Fine, sunshiny day.
2 Sunday,	29·980	69	72	71	72	54	S. E.	10	Do.	Do.	. .	Very fine day.
3 Monday,	29·800	68	71	70	71	55	S. E.	10	Do.	Do.	. .	Strong breeze, light rain.
4 Tuesday,	29·740	68	72	70	72	60	S. W.	3	Few,	Do.	·070	Breezy, fine day.
5 Wednesday,	29·800	69	73	72	74	58	S. W.	10	Many,	Do.	. .	Do.
6 Thursday,	29·800	66	69	67	70	56	N. W.	10	Do.	Do.	. .	Fine day, changeable.
7 Friday,	29·750	68	71	69	71	54	N. E.	10	Do.	Do.	. .	Do.
8 Saturday,	29·700	65	68	66	69	53	N. E.	8	Do.	Do.	. .	Do.
9 Sunday,	29·710	66	68	66	69	46	N. W.	6	Do.	Do.	·410	Showery day.
10 Monday,	29·720	69	72	70	72	49	N. W.	9	Do.	Do.	·820	Do.
11 Tuesday,	29·800	61	65	63	65	46	N. W.	10	Do.	Do.	·220	Do.
12 Wednesday,	29·900	62	65	64	66	46	W.	8	Do.	Do.	·100	Do.
13 Thursday,	29·680	67	70	68	70	58	S. W.	10	Do.	Do.	. .	Gloomy, and changeable.
14 Friday,	29·730	68	71	68	71	56	S. W.	10	Do.	Do.	. .	Changeable, strong breeze.
15 Saturday,	29·740	67	70	68	70	50	S. W.	8	Do.	Do.	·020	Showery A. M., fine P. M.
16 Sunday,	29·750	66	68	66	69	47	S. W.	2	Do.	Do.	·030	Do.
17 Monday,	29·710	68	71	69	71	46	N. E.	10	Do.	Do.	·040	Do.
18 Tuesday,	29·600	65	66	64	67	45	N. E.	2	Do.	Do.	. .	Very fine day.
19 Wednesday,	29·580	66	69	67	69	50	N. E.	9	Do.	Do.	·700	Thunder, and heavy rain.
20 Thursday,	29·600	64	65	63	66	53	S. E.	6	Do.	Do.	·020	Fine, sunshiny day.
21 Friday,	29·740	65	69	67	69	55	S. E.	6	Do.	Do.	·100	Thunder, and heavy rain.
22 Saturday,	29·930	66	69	67	69	49	S. E.	8	Do.	Do.	. .	Fine, mild day.
23 Sunday,	29·980	66	69	68	70	55	S. E.	10	Do.	Do.	. .	Do.
24 Monday,	30·200	67	71	70	71	56	E.	10	Do.	Do.	. .	Fine, sunshiny day.
25 Tuesday,	30·280	68	72	71	73	53	S. E.	8	Do.	Do.	. .	Do.
26 Wednesday,	30·240	67	69	68	69	48	S. E.	9	Do.	Do.	. .	Fine, breezy day.
27 Thursday,	30·000	68	70	68	71	50	S. W.	8	Do.	Do.	. .	Misty rain A. M., fine P.M.
28 Friday,	29·970	69	71	70	72	54	S. W.	10	Do.	Do.	. .	Fine day.
29 Saturday,	29·050	67	70	69	71	55	S. W.	10	Do.	Do.	. .	Drizzling rain A.M., fine P.M.
30 Sunday,	29·950	65	67	65	67	47	S. W.	9	Do.	Do.	. .	Fine, but changeable.
31 Monday,	29·800	64	66	64	68	45	S. W.	8	Do.	Do.	. .	Do.
								257	Total Amount of Rain,		2·030	inches.

AUGUST, 1865.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Tuesday, ...	29·790	62	65	63	65	40	S. E.	7	Many, . .	Broken, . .	·210	Heavy rain P. M.
2 Wednesday, . .	29·820	63	65	63	66	41	N. W.	10	Do. . .	Do. . . .	·020	Fine, breezy day.
3 Thursday, . . .	29·910	67	69	68	70	46	S. E.	10	Do. . .	Do. . . .	. .	Sultry, warm day.
4 Friday, ...	29·800	66	69	67	69	56	S. W.	10	Do. . .	Do. . . .	. .	Very fine day.
5 Saturday, . . .	29·790	67	69	67	70	56	S. E.	10	Do. . .	Do. . . .	·010	Light rain P. M.
6 Sunday, ...	29·840	62	65	63	67	49	N. W.	8	Do. . .	Do. . . .	·020	Showery day.
7 Monday, ...	29·910	65	67	66	70	56	N. W.	10	Do. . .	Do. . . .	·010	Showery A. M.; fair P. M.
8 Tuesday, ...	29·930	66	66	67	70	54	S. E.	10	Do. . .	Do. . . .	. .	Fine, warm day.
9 Wednesday, . .	29·800	63	67	65	67	56	S. W.	3	Do. . .	Do. . . .	·410	Heavy rain P. M.
10 Thursday, . . .	29·490	62	63	61	63	58	S. E.	0	Do. . .	Do. . . .	·360	Very wet day.
11 Friday, ...	29·890	63	65	63	66	56	S. W.	10	Do. . .	Do. . . .	1·420	Rain A. M., fine P. M.
12 Saturday, . . .	29·910	58	59	57	60	43	S. E.	0	Do. . .	Do. . . .	·299	Showery day.
13 Sunday, ...	29·480	57	59	57	60	44	S. E.	3	Do. . .	Do. . . .	·080	Do.
14 Monday, ...	29·690	65	68	66	68	50	S. W.	8	Do. . .	Do. . . .	·130	Fair A. M., rain P. M.
15 Tuesday, . . .	29·450	62	65	63	65	56	N. W	8	Do. . .	Do. . . .	·590	Rain A. M., fair P. M.
16 Wednesday, . .	29·640	61	63	61	63	53	N. W.	8	Do. . .	Do. . . .	·010	Showery day.
17 Thursday, . . .	29·800	63	65	63	65	49	N. E.	9	Do. . .	Do. . . .	. .	Very fine day.
18 Friday, ...	29·630	61	64	62	65	47	N. E.	7	Do. . .	Do. . . .	. .	Changeable, but fine.
19 Saturday, . . .	29·640	59	61	59	61	47	N. E.	8	Do. . .	Do. . . .	. .	Do.
20 Sunday, ...	29·640	61	63	62	64	46	N. E.	9	Do. . .	Do. . . .	·090	Rain A. M., fine P. M.
21 Monday, ...	29·700	64	68	68	62	53	E.	9	Do. . .	Do. . . .	. .	Fine, mild day.
22 Tuesday, . . .	29·610	65	68	66	69	54	N. E.	8	Do. . .	Do. . . .	. .	Fine, sunshiny day.
23 Wednesday, . .	29·500	60	61	59	62	56	N. E	0	Do. . .	Do. . . .	·070	Dull, and showery.
24 Thursday, . . .	29·620	63	67	65	67	50	N. W.	8	Do. . .	Do. . . .	·310	Rain A. M., fine P. M.
25 Friday, ...	29·640	61	64	63	64	47	W.	9	Do. . .	Do. . . .	. .	Fine, mild day.
26 Saturday, . . .	29·830	62	63	62	64	48	W.	9	Do. . .	Do. . . .	. .	Fine, mild day.
27 Sunday, ...	30·020	66	67	66	70	50	S. W.	9	Do. . .	Do. . . .	·020	Changeable A. M., fine P. M.
28 Monday, ...	30·100	60	64	63	64	48	N. E.	8	Do. . .	Do. . . .	. .	Very fine day.
29 Tuesday, ...	30·150	59	62	60	62	45	N. E.	6	Do. . .	Do. . . .	. .	Do.
30 Wednesday, . .	30·250	60	63	62	65	44	E.	9	Do. . .	Do . . .	. .	Changeable, but fine.
31 Thursday, . . .	30·200	62	65	64	67	40	S. W.	9	Do. . .	Do. . . .	. .	Very fine day.
								232	Total Amount of Rain,		3·950	Inches.

SEPTEMBER, 1865.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Friday, ...	30·160	69	70	69	73	46	W.	10	Many, . .	Broken, . . .	. .	Very fine day.
2 Saturday, ...	30·120	68	71	70	71	41	S. W.	10	Do. . .	Do. . . .	. .	Do.
3 Sunday, ...	30·020	70	74	73	75	58	W.	10	Few, . .	Do . . .	. .	Do.
4 Monday, ...	30·020	69	72	71	72	57	W.	10	Do. . .	Do. . . .	. .	Do.
5 Tuesday, ...	30·020	69	71	70	72	56	S. W.	9	Many, . .	Do. . . .	. .	Fine, breezy day.
6 Wednesday, . . .	29·980	70	73	71	73	58	S.	10	Do. . .	Do. . . .	. .	Breezy, and changeable.
7 Thursday, ...	29·960	71	73	72	74	61	S. E.	10	Do. . .	Do. . . .	. .	Sunshine A. M., cloudy P. M.
8 Friday, ...	29·720	70	71	70	73	58	S. W.	10	Do. . .	Do. . . .	. .	Do.
9 Saturday, . . .	29·780	66	67	66	69	57	S. W.	8	Do. . .	Do. . . .	·010	Drizzling A. M., strong breeze P. M.
10 Sunday, ...	30·040	69	71	70	73	57	S. W.	10	Do. . .	Do. . . .	·010	Light rain A. M., fair P. M.
11 Monday, ...	30·160	68	70	69	72	53	S. W.	10	Few, . .	Do. . . .	. .	Very fine day.
12 Tuesday, ...	30·300	73	75	74	75	59	S. W.	10	Do. . .	Do, . . .	·010	Light rain A. M.
13 Wednesday, . . .	30·200	70	73	72	73	58	S. E.	10	Do. . .	Do. . . .	. .	Very fine day.
14 Thursday, ...	30·210	73	75	74	76	60	S. E.	10	Do. . .	Do. . . .	. .	Do.
15 Friday, ...	30·300	75	77	76	79	61	S. W.	10	Do. . .	Do. . . .	. .	Very warm day.
16 Saturday, ...	30·350	69	71	70	72	58	S. W.	10	None, . .	. . . .	. .	Do.
17 Sunday, ...	30·350	71	75	74	76	60	S. E.	10	Do. . .	. . . .	. .	Do.
18 Monday, ...	30·400	70	73	72	74	46	E.	10	Do. . .	. . . .	. .	Do.
19 Tuesday, ...	30·240	67	69	68	70	43	E.	10	Many, . .	Do. . . .	. .	Foggy A. M., clear P. M.
20 Wednesday, . . .	29·950	59	59	57	60	47	W.	0	Few, . .	Do. . . .	. .	Cloudy A. M., showery P. M.
21 Thursday, ...	30·350	59	63	61	64	45	N. W.	8	Many, . .	Do. . . .	. .	Cloudy A. M., clear P. M.
22 Friday, ...	30·400	60	64	63	65	39	N. W.	9	None, . .	. . . .	. .	Dull, and changeable.
23 Saturday, ...	30·450	63	65	64	65	40	S. E.	10	Do. . .	Do. . . .	. .	Fine, sunshiny day.
24 Sunday, ...	30·350	63	65	64	65	40	N. E.	10	Few, . .	Do. . . .	. .	Fine, breezy day.
25 Monday, ...	30·200	65	67	65	67	39	E.	10	None, . .	. . . .	. .	Do.
26 Tuesday, ...	30·100	65	67	65	67	47	E.	10	Few, . .	Do. . . .	. .	Foggy A. M., clear P. M.
27 Wednesday, . . .	29·950	66	69	66	69	53	N. E.	10	Do. . .	Do. . . .	. .	Fine, sunshiny day.
28 Thursday, . . .	30·164	64	66	64	67	47	E.	10	Do. . .	Do. . . .	. .	Fine, breezy day.
29 Friday, ...	30·150	61	64	63	65	45	S. E.	10	Do. . .	Do. . . .	. .	Do.
30 Saturday, ...	30·010	62	63	62	64	48	S. E.	8	Do. . .	Do. . . .	. .	Breezy, and changeable.
								282	Total Amount of Rain,		0·030	inches.

OCTOBER, 1865.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Sunday,	29·920	63	64	63	65	52	S. E.	8	Many,	Broken,		Breezy, and changeable.
2 Monday,	29·850	60	62	60	63	47	S. E.	7	Do.	Do.		Do.
3 Tuesday,	30·080	63	65	63	65	57	S. E.	10	Few,	Do.		Fine, sunshiny day.
4 Wednesday,	30·080	63	64	63	64	56	E.	10	None,			Fine, clear day.
5 Thursday,	29·950	63	64	63	65	45	S. E.	10	Do.			Do.
6 Friday,	29·950	62	65	62	65	45	E.	10	Do.			Fine, breezy day.
7 Saturday,	29·700	59	62	60	63	47	E.	10	Many,	Do.		Breezy and changeable.
8 Sunday,	29·400	57	59	57	60	47	E.	0	Do.	Do.	·400	Heavy rain A. M.
9 Monday,	29·250	59	61	59	61	47	S. E.	3	Do.	Do.	·320	Showery A. M., fair P. M.
10 Tuesday,	29·250	60	61	60	63	53	N. E.	8	Do.	Do.	·010	Fine, mild day.
11 Wednesday,	29·254	57	58	56	60	50	N. W.	2	Do.	Do.	·110	Dull, and gloomy.
12 Thursday,	29·860	52	53	52	55	47	W.	0	Do.	Do.	·680	Very wet day.
13 Friday,	29·864	52	54	52	54	49	N. W.	0	Do.	Do.		Dull, and gloomy.
14 Saturday,	29·890	50	52	53	54	47	W.	6	Few,	Do.		Fine, mild day.
15 Sunday,	29·850	53	55	53	56	37	N. W.	6	Many,	Do.		Fine, mild day.
16 Monday,	29·780	52	54	52	55	38	S. W.	4	Do.	Do.	·180	Rain A. M., fair P. M.
17 Tuesday,	29·200	51	54	52	59	40	W.	8	Do.	Do.	·030	Fine, mild day.
18 Wednesday,	29·300	52	53	51	55	37	N. W.	0	Do.	Do.	·210	Showery day.
19 Thursday,	29·400	56	57	54	59	35	W.	8	None,		·030	Light frost A. M., clear P. M.
20 Friday,	29·500	54	57	56	58	30	N. W.	8	Do.			Fine, clear day.
21 Saturday,	29·578	48	50	48	50	32	N. W.	8	Do.			Do.
22 Sunday,	29·600	47	49	47	50	30	N. E.	2	Do.		·060	Showery day.
23 Monday,	29·600	46	48	46	50	32	E.	4	Do.		·030	Do.
24 Tuesday,	29·380	53	54	51	54	41	S. W.	3	Do.		·330	Do.
25 Wednesday,	29·770	51	52	51	53	44	W.	6	Few,	Do.	·010	Fine, clear day.
26 Thursday,	29·090	50	51	50	52	40	W.	5	Many,	Do.	·690	Showery day.
27 Friday,	29·000	49	50	49	52	41	N. W.	6	Do.	Do.		Fine, mild day.
28 Saturday,	29·724	44	44	42	49	40	W.	6	Do.	Do.		Do.
29 Sunday,	29·000	50	51	49	53	41	N. W.	3	Do.	Do.	·150	Gloomy A. M., rain P. M.
30 Monday,	29·030	46	47	45	50	40	N. W.	6	Do.	Do.	·020	Do.
31 Tuesday,	29·730	47	48	47	51	40	N. W.	7	Few,	Do.	·090	Fine, clear day.
								174	Total Amount of Rain,		3·350	inches.

NOVEMBER, 1865.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Wednesday, . .	29·950	46	47	46	48	36	N.	7	Few, . .	Broken, . .	. .	Fine, clear day.
2 Thursday, . . .	29·900	47	47	46	47	35	W.	6	Many, . .	Do. . . .	·030	Rain A. M., breezy P. M.
3 Friday, ...	30·040	47	48	47	49	35	W.	3	Few, . .	Do. . . .	. .	Fine, clear day.
4 Saturday, . . .	30·140	46	47	46	48	35	W.	8	Many, . .	Do. . . .	. .	Fine, mild day.
5 Sunday, ...	30·148	48	46	44	47	27	N.	3	Do. . .	Do. . . .	. .	Frost A. M., light rain P. M.
6 Monday, ...	30·340	44	45	44	47	34	N.	5	Do. . .	Do. . . .	·020	Dull, and gloomy.
7 Tuesday, ...	30·320	46	46	46	47	36	N.	4	Do. . .	Do. . . .	. .	Do.
8 Wednesday, . .	30·150	45	45	45	46	41	N.	4	Do. . .	Do. . . .	. .	Do.
9 Thursday, . . .	30·100	46	47	46	47	32	W.	0	Do. . .	Do. . . .	. .	Do.
10 Friday, ...	30·300	46	46	45	45	34	N. W.	0	Do. . .	Do. . . .	. .	Do.
11 Saturday, . . .	30·240	49	50	49	51	48	W.	6	Do. . .	Do. . . .	. .	Breezy, fine day.
12 Sunday, ...	30·280	47	48	47	49	42	S. E.	5	Do. . .	Do. . . .	. .	Do.
13 Monday, ...	30·100	47	48	47	49	44	S. E.	3	Do. . .	Do. . . .	. .	Strong breeze, changeable.
14 Tuesday, . . .	30·120	48	48	47	49	39	S.	0	Do. . .	Do. . . .	. .	Dull, and gloomy.
15 Wednesday, . .	30·250	47	48	47	50	35	W.	6	None, . .	. . . .	. .	Fine, clear day.
16 Thursday, . . .	29·800	55	57	56	59	32	S. W.	0	Many, . .	Do. . . .	·010	Gloomy A. M., showery P. M.
17 Friday, ...	29·810	50	53	51	55	37	S. W.	8	Do. . .	Do. . . .	. .	Do.
18 Saturday, . . .	29·900	49	51	50	52	35	S. W.	0	Do. . .	Do. . . .	. .	Do.
19 Sunday, ...	29·500	51	53	51	53	34	W.	3	Do. . .	Do. . . .	·100	Dull, and gloomy.
20 Monday, ...	29·200	47	49	47	50	30	W.	4	Do. . .	Do. . . .	·020	Do.
21 Tuesday, . . .	28·820	47	50	48	51	33	S. E.	5	Do. . .	Do. . . .	·010	Breezy, fine day.
22 Wednesday, . .	28·750	47	47	45	49	42	S.	3	Do. . .	Do. . . .	·500	Showery day.
23 Thursday, . . .	29·250	47	48	47	49	43	W.	5	Do. . .	Do. . . .	. .	Fine, breezy day.
24 Friday, ...	29·124	42	42	40	43	42	S. W.	0	Do. . .	Do. . . .	·510	Stormy, wet day.
25 Saturday, . . .	28·700	47	48	46	49	35	S. E.	0	Do. . .	Do. . . .	·860	Very wet day.
26 Sunday, ...	29·300	46	47	45	47	40	W.	4	Do. . .	Do. . . .	·240	Fair A. M., showery P. M.
27 Monday, ...	29·350	44	45	44	45	30	S. E.	0	Do. . .	Do. . . .	·020	Do.
28 Tuesday, ...	29·150	44	45	43	43	42	N. W.	0	Do. . .	Do. . . .	·340	Showery day.
29 Wednesday, . .	29·600	48	49	48	50	35	W.	0	Do. . .	Do. . . .	. .	Gloomy, and changeable.
30 Thursday, . . .	29·700	46	46	44	46	38	S. E.	0	Do. . .	Do. . . .	·050	Showery day.
								92	Total Amount of Rain,		2·710	inches.

DECEMBER, 1865.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Friday,	29·850	45	46	44	47	33	S.	3	Many,	Broken,	·060	Showery day.
2 Saturday,	29·500	46	48	46	48	39	S. E.	0	Do.	Do.	·170	Stormy, and showery.
3 Sunday,	29·310	41	43	41	43	39	N. E	0	Do.	Do.	·510	Showery day.
4 Monday,	29·400	45	46	44	46	33	N. E.	0	Do.	Do.	·480	Very wet day.
5 Tuesday,	29·472	47	48	47	48	38	E.	0	Do.	Do.	·120	Dull, and changeable.
6 Wednesday,	29·500	54	55	54	55	46	S. E.	0	Do.	Do.	·110	Showery day.
7 Thursday,	29·870	47	48	47	49	40	S. E.	2	Do.	Do.	. .	Fine, but changeable.
8 Friday,	30·350	47	49	48	50	36	N. W.	4	Do.	Do.	. .	Dull, and gloomy.
9 Saturday,	30·254	47	49	48	50	40	W.	4	Do.	Do.	. .	Fine, mild day.
10 Sunday,	30·600	48	50	48	50	46	S. W.	0	Do.	Do.	. .	Dull, and hazy.
11 Monday,	30·600	47	48	47	49	44	S. W.	0	Do.	Do.	. .	Do.
12 Tuesday,	30·500	45	46	45	47	45	S.	0	Do.	Do.	. .	Do.
13 Wednesday,	30·450	41	42	41	44	39	W.	4	Do.	Do.	. .	Do.
14 Thursday,	30·540	42	44	43	45	40	W.	0	Do.	Do.	. .	Dull, and changeable.
15 Friday,	30·700	41	42	41	45	33	W.	2	Do.	Do.	. .	Do.
16 Saturday,	30·650	43	44	43	44	40	W.	2	Do.	Do.	. .	Do.
17 Sunday,	30·500	43	44	43	45	39	W.	0	Do.	Do.	. .	Dull, and cloudy.
18 Monday,	30·300	42	44	43	44	38	S. W.	0	Do.	Do.	. .	Do.
19 Tuesday,	30·250	44	45	44	46	40	S. W.	0	Do.	Do.	. .	Do.
20 Wednesday,	30·000	44	45	44	45	42	S. W.	0	Do.	Do.	. .	Strong breeze, changeable.
21 Thursday,	29·910	52	55	54	55	42	S. W.	0	Do.	Do.	. .	Do.
22 Friday,	30·000	51	52	51	52	41	S. E.	3	Do.	Do.	. .	Do.
23 Saturday,	30·100	50	51	50	51	48	N. E.	5	Do.	Do.	. .	Stormy A. M., fine P. M.
24 Sunday,	30·050	52	54	53	55	40	N. E.	2	Do.	Do.	. .	Dull, and changeable.
25 Monday,	30·080	50	52	51	52	39	N. W.	0	Do.	Do.	·020	Light showers, changeable.
26 Tuesday,	30·080	41	43	42	43	40	W.	3	Do.	Do.	·480	Heavy rain A. M., fair P. M.
27 Wednesday,	30·000	45	46	45	46	36	S. W.	4	Do.	Do.	. .	Fine, breezy day.
28 Thursday,	29·500	46	47	46	47	39	S. W.	6	Do.	Do.	. .	Do.
29 Friday,	29·480	39	41	39	42	38	N. W.	0	Do.	Do.	·280	Very wet day.
30 Saturday,	29·400	37	39	37	39	32	S. W.	2	Do.	Do.	·150	Snow A. M., fair P. M.
31 Sunday,	29·350	36	38	36	38	34	S. W.	3	Do.	Do.	·490	Showery day.
								49	Total Amount of Rain.		2·870	inches.

JANUARY, 1866.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Monday, ...	29·540	38	38	37	38	34	S. W.	4	Many, . .	Broken, . .	·030	Showery day.
2 Tuesday, ...	29·170	47	48	46	49	35	S. E.	0	Do. . .	Do. . . .	·090	Stormy, wet day.
3 Wednesday, . . .	29·200	45	46	44	47	36	S. W.	2	Do. . .	Do. . . .	·020	Fine, mild day.
4 Thursday, ...	29·350	35	35	34	35	33	W.	0	Do. . .	Do. . . .	·220	Wet, sleety day.
5 Friday, ...	29·750	39	39	38	39	32	S. W.	6	None, . .	. . . .	. .	Clear, like frost.
6 Saturday, ...	29·840	40	41	40	42	35	S. W.	5	Do. . .	. . . . . .	. .	Do.
7 Sunday, ...	29·390	43	44	42	45	37	S. W.	0	Do. . .	. . . .	·080	Showery day.
8 Monday, ...	29·082	42	42	41	42	39	W.	4	Do. . .	. . . .	·070	Very stormy day.
9 Tuesday, ...	28·850	36	37	35	38	31	S. W.	2	Do. . .	. . . .	·010	Snow A. M., stormy P. M.
10 Wednesday, . . .	29·170	34	34	33	37	34	N. W.	4	Do. . .	. . . .	·270	Fine, clear day.
11 Thursday, ...	29·350	34	35	34	36	29	W.	6	Do. . .	. . . .	. .	Do.
12 Friday, ...	29·780	34	34	33	36	29	S. W.	3	Many, . .	Do. . . .	. .	Cloudy, and overcast.
13 Saturday, ...	29·400	52	53	52	53	33	S. W.	0	Do. . .	Do. . . .	·110	Showery day.
14 Sunday, ...	29·570	60	51	50	52	39	S. W.	0	Do. . .	Do. . . .	·020	Do.
15 Monday, ...	29·830	43	44	43	45	37	S. W.	4	Do. . .	Do. . . .	·010	Breezy, cold day.
16 Tuesday, ...	29·900	45	46	45	48	40	N. W.	2	Do. . .	Do. . . .	·080	Showery day.
17 Wednesday, . . .	29·972	52	54	53	54	41	W.	0	Do. . .	Do. . . .	·040	Do.
18 Thursday, ...	29·500	51	52	51	52	48	S.	3	Do. . .	Do. . . .	. .	Fine, mild day.
19 Friday, ...	29·400	43	45	43	47	43	S. W.	2	Do. . .	Do. . . .	·100	Showery A. M., fair P. M.
20 Saturday, ...	29·480	44	44	43	47	41	S. W.	4	Do. . .	Do. . . .	·080	Fine, mild day.
21 Sunday, ...	29·480	45	46	45	47	41	S. W.	0	Do. . .	Do. . . .	·030	Do.
22 Monday, ...	29·460	45	45	44	47	39	W.	3	Do. . .	Do. . . .	·040	Stormy, wet day.
23 Tuesday, ...	30·400	45	46	45	47	40	W.	5	Do. . .	Do. . . .	·080	Fine, breezy day.
24 Wednesday, . . .	30·480	43	45	44	45	37	W.	5	Do. . .	Do. . . .	. .	Do.
25 Thursday, ...	30·500	50	51	50	51	42	S. W.	4	Do. . .	Do. . . .	. .	Do.
26 Friday, ...	30·400	44	46	45	47	43	S. W.	0	Do. . .	Do. . . .	. .	Dull, and gloomy.
27 Saturday, ...	30·080	46	47	46	47	43	S.	0	Do. . .	Do. . . .	. .	Do.
28 Sunday, ...	29·800	43	45	44	45	40	S. W.	0	Do. . .	Do. . . .	. .	Do.
29 Monday, ...	29·750	40	42	40	43	34	W.	3	Do. . .	Do. . . .	·020	Breezy, cold day.
30 Tuesday, ...	29·390	39	40	39	42	31	W.	0	Do. . .	Do. . . .	·180	Showery P. M.
31 Wednesday, . . .	29·224	47	48	46	48	42	S. W.	3	Do. . .	Do. . . .	·020	Do.
								74	Total Amount of Rain,		1·490	inches.

FEBRUARY, 1866.

DATE.	BAROMETER.	THERMOMETER.					WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Thursday, . . .	28·990	51	53	51	53	43	S. W.	0	Many, . .	Broken, . .	·030	Showery P. M.
2 Friday, ...	29·594	40	41	39	43	42	W.	4	Do. . .	Do. . . .	·060	Cold, and showery.
3 Saturday, . . .	29·594	42	43	42	45	37	N. W.	4	Do. . .	Do. . . .	·220	Rain A. M., fair P. M.
4 Sunday, ...	29·480	40	42	40	45	37	W.	3	Do. . .	Do. . . .	·360	Stormy, wet day.
5 Monday, ...	29·640	49	51	49	52	41	S. W.	2	Do. . .	Do. . . .	·040	Stormy day.
6 Tuesday, . . .	29·500	50	51	50	52	45	S. W.	4	Do. . .	Do. . . .	·020	Stormy, and showery.
7 Wednesday, . .	29·500	44	45	44	47	40	N. W.	4	Do. . .	Do. . . .	·210	Cold, showery day.
8 Thursday, . . .	29·840	43	44	43	46	35	S. W.	5	Do. . .	Do. . . .	·090	Fine, but cold.
9 Friday, ...	29·412	48	48	47	50	39	S. W.	6	Do. . .	Do. . . .	·010	Fine, breezy day.
10 Saturday, . . .	29·150	45	46	44	48	40	S. W.	4	Do. . .	Do. . . .	·040	Heavy rain A. M., fair P. M.
11 Sunday, ...	28·900	41	42	40	45	35	N.	6	Do. . .	Do. . . .	. .	Fine, breezy day.
12 Monday, ...	29·450	37	37	46	40	31	N. W.	4	Do. . .	Do. . . .	. .	Frost A. M., showery P. M.
13 Tuesday, ...	29·640	36	37	46	37	27	N. W.	7	Few, . .	Do. . . .	·010	Clear, like frost.
14 Wednesday, . .	29·050	42	42	41	43	27	S. W.	8	Many, . .	Do. . . .	·010	Breezy, and changeable.
15 Thursday, . . .	29·150	36	37	46	38	34	S. E.	0	Do. . .	Do. . . .	·090	Showery day.
16 Friday, ...	29·480	42	44	42	45	57	S. W.	6	Do. . .	Do. . . .	. .	Fine, mild day.
17 Saturday, . . .	29·980	36	38	36	39	29	N.	6	Few, . .	Do. . . .	. .	Clear, like frost.
18 Sunday, ...	29·990	36	37	36	39	25	W.	8	None, . .	. . . . . .	. .	Do.
19 Monday, ...	29·940	37	39	37	39	25	W.	0	Many, . .	Broken, . .	·020	Dull, and showery.
20 Tuesday, ...	30·420	41	42	41	42	30	W.	7	None, . .	. . . . . .	. .	Fine, clear day.
21 Wednesday, . .	30·250	42	44	43	44	26	N. W.	8	Many, . .	Broken, . .	. .	Fine, mild day.
22 Thursday, . . .	29·930	49	50	49	50	40	S. W.	6	Do. . .	Do. . . .	·010	Fine, breezy day.
23 Friday, ...	29·670	43	44	42	45	43	W.	5	Do. . .	Do. . . .	·030	Strong breeze, fine day.
24 Saturday, . . .	29·440	40	41	39	42	31	W.	8	Do. . .	Do. . . .	·020	Frost A. M., rain P. M.
25 Sunday, ...	29·150	40	40	39	42	39	S. W.	0	Do. . .	Do. . . .	·130	Heavy rain P. M.
26 Monday, ...	29·340	40	42	40	43	26	N. E.	7	Do. . .	Do. . . .	·010	Do.
27 Tuesday, . . .	29·626	36	38	36	39	34	N. E.	6	Do. . .	Do. . . .	·110	Cold, breezy day.
28 Wednesday, . .	29·440	34	36	34	37	27	N.	8	Do. . .	Do. . . .	030	Snow A. M., frosty P. M.
								126	Total Amount of Rain.		1·330	inches.

MARCH, 1866.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day. At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Thursday, . . .	29·530	33	35	33	35	28	N. E.	8	Many, . .	Broken, . .	·020	Snow A. M., frost P. M.
2 Friday,.	29·730	38	39	38	40	25	N.	9	Few, . .	Do. . . .	. .	Fine, clear day.
3 Saturday,. . . .	29·528	36	37	36	39	31	N. W.	0	Many, .	Do. . . .	·030	Gloomy A. M., rain P. M.
4 Sunday, ...	29·750	36	37	36	39	26	N. W.	6	Do. . .	Do. . . .	. .	Calm, and changeable.
5 Monday, ...	29·400	39	41	39	41	19	S.	6	Do. . .	Do. . . .	. .	Keen frost A. M., changeable P. M.
6 Tuesday, ...	29·128	38	39	38	41	30	S. W.	8	Do. . .	Do. . . .	·130	Cloudy, and changeable.
7 Wednesday,. . .	29·250	40	41	40	41	23	N. W.	9	Do. . .	Do. . . .	. .	Clear, like frost.
8 Thursday,. . .	29·820	39	41	40	41	29	W.	8	Do. . .	Do. . . .	·030	Hail showers, cold and changeable.
9 Friday,.	30·212	45	47	45	46	29	N.	9	Do. . .	Do. . . .	. .	Fine, breezy day.
10 Saturday,. . . .	30·450	47	49	48	50	34	N.	8	Do. . .	Do. . . .	. .	Fine, but chilly.
11 Sunday, ...	30·300	48	49	48	50	42	W.	8	Do. . .	Do. . . .	. .	Do.
12 Monday, ...	29·722	44	46	44	47	41	W.	6	Do. . .	Do. . . .	·100	Showery day.
13 Tuesday, ...	29·700	42	43	42	45	37	N.	9	Do. . .	Do. . . .	. .	Fine, clear day.
14 Wednesday, . .	29·300	39	40	39	44	25	S. E.	9	Few, . .	Do. . . .	. .	Breezy, fine day.
15 Thursday, . . .	28·740	42	43	41	43	34	S.	3	Many, . .	Do. . . .	·750	Very wet day.
16 Friday,.	28·932	45	46	44	46	34	S. E.	0	Do. . .	Do. . . .	·040	Showery day.
17 Saturday, . . .	28·982	46	48	46	48	35	S. E.	6	Do. . .	Do. . . .	·290	Fine, and mild.
18 Sunday, ...	29·000	40	42	40	43	39	E.	0	Do. . .	Do. . . .	·030	Dull, and gloomy.
19 Monday, ...	29·280	43	45	44	47	40	N. E.	6	Do. . .	Do. . . .	·020	Fine, breezy day.
20 Tuesday, ...	29·446	39	40	38	40	37	N. E.	0	Do. . .	Do. . . .	·220	Very wet day.
21 Wednesday, . .	29·650	40	42	41	42	34	N. E.	8	Few, . .	Do. . . .	·610	Fine, clear day.
22 Thursday, . . .	29·700	38	39	38	40	31	S. E.	0	Many, . .	Do. . . .	·020	Frost A. M., rain P. M.
23 Friday, ...	28·682	43	44	43	44	39	S. E.	0	Do. . .	Do. . . .	·870	Very stormy, wet day.
24 Saturday, . . .	29·100	42	44	42	44	41	N. W.	0	Do. . .	Do. . . .	·180	Rain A. M., fair P. M.
25 Sunday, ...	29·510	44	46	44	48	39	S. E.	4	Do. . .	Do. . . .	·040	Fine, mild day.
26 Monday, ...	29·838	55	54	53	55	40	S. W.	0	Do. . .	Do. . . .	. .	Do.
27 Tuesday, ...	29·980	53	56	55	57	45	S. W.	3	Do. . .	Do. . . .	. .	Do.
28 Wednesday, . . .	29·924	55	56	55	56	43	W.	2	Do. . .	Do. . . .	·030	Mild, and showery.
29 Thursday, . . .	30·000	54	56	55	56	51	S. W.	8	Do. . .	Do. . . .	·020	Fine, mild day.
30 Friday,.	30·100	55	57	56	57	49	W.	3	Do. . .	Do. . . .	. .	Do.
31 Saturday,. . . .	29·750	48	49	48	51	41	S. W.	8	Do. . .	Do. . . .	. .	Do.
								154	Total Amount of Rain,		3·430	inches.

APRIL, 1866.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Sunday, ...	29·430	45	47	45	48	40	N. E.	3	Many, . .	Broken, . .	·070	Rain A. M., fair P. M.
2 Monday, ...	29·680	40	41	39	42	37	N. E.	8	Do. . .	Do. . . .	·400	Wet, stormy day.
3 Tuesday, ...	29·680	44	45	44	47	32	N. E.	8	Do. . .	Do. . . .	·040	Showery day.
4 Wednesday, . . .	29·460	40	41	40	42	30	S. E.	0	Do. . .	Do. . . .	·230	Very wet day.
5 Thursday, ...	29·924	45	47	46	47	37	S. E.	9	Do. . .	Do. . . .	·130	Fine, breezy day.
6 Friday, ...	30·040	45	47	46	47	40	N. E.	4	Do. . .	Do. . . .	. .	Breezy, and cold.
7 Saturday, ...	30·024	47	49	48	49	42	S. E.	8	Do. . .	Do. . . .	. .	Do.
8 Sunday, ...	30·028	44	46	44	46	42	N. E.	2	Do. . .	Do. . . .	. .	Showery A. M., fair P. M.
9 Monday, ...	29·150	44	46	44	47	43	N. E.	6	Do. . .	Do. . . .	. .	Do.
10 Tuesday, ...	29·650	47	49	47	49	42	E.	1	Do. . .	Do. . . .	·010	Fine, mild day.
11 Wednesday, . . .	29·320	47	48	46	48	44	E.	0	Do. . .	Do. . . .	·040	Showery day.
12 Thursday, ...	29·400	47	51	49	52	38	S. E.	8	Do. . .	Do. . . .	·120	Strong breeze, showery day.
13 Friday, ...	29·500	54	56	55	56	45	S. W.	7	Do. . .	Do. . . .	·020	Showery day.
14 Saturday, ...	29·800	50	51	50	55	44	S. W.	6	Do. . .	Do. . . .	·100	Dull, and gloomy.
15 Sunday, ...	29·800	50	52	51	54	43	S. W.	3	Do. . .	Do. . . .	·050	Do.
16 Monday, ...	29·850	51	52	51	52	40	S.	3	Do. . .	Do. . . .	·020	Do.
17 Tuesday, ...	29·800	53	54	53	54	42	S.	4	Do. . .	Do. . . .	·020	Do.
18 Wednesday, . . .	29·780	54	55	54	55	41	S.	6	Do. . .	Do. . . .	. .	Do.
19 Thursday, ...	29·540	53	55	54	57	47	S. W.	7	Do. . .	Do. . . .	·280	Heavy showers during day.
20 Friday, ...	29·650	50	53	52	53	41	S. W.	8	Do. . .	Do. . . .	. .	Fine, breezy day.
21 Saturday, ...	30·130	57	62	60	62	39	S. W.	9	Do. . .	Do. . . .	. .	Fine, mild day.
22 Sunday, ...	30·200	52	55	54	56	44	N. E.	9	Do. . .	Do. . . .	. .	Fine, breezy day.
23 Monday, ...	30·212	54	56	55	57	45	N. E.	9	Do. . .	Do. . . .	. .	Do.
24 Tuesday, ...	30·190	53	56	55	58	48	S. E.	9	Do. . .	Do. . . .	. .	Do.
25 Wednesday, . . .	30·000	55	57	56	58	45	S. E.	9	Do. . .	Do. . . .	. .	Do.
26 Thursday, ...	29·700	63	66	65	66	46	N. E.	9	Do. . .	Do. . .	. .	Very warm day.
27 Friday, ...	29·650	61	64	63	65	47	N. E.	9	Do. . .	Do. . . .	·100	Rain P. M.
28 Saturday, ...	29·640	51	54	52	55	50	N. E.	9	Do. . .	Do. . . .	. .	Fine, breezy day.
29 Sunday, ...	29·700	45	49	45	50	36	N. E.	6	Do. . .	Do. . . .	. .	Dull, and changeable.
30 Monday, ...	29·800	44	47	45	49	35	N. E.	9	Few, . .	Do. . . .	·080	Rain A. M., fine P. M.
								183	Total Amount of Rain,		1·210	inches.

MAY, 1866.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Tuesday, ...	29·600	42	43	41	45	35	N. E.	8	Many, . .	Broken, . .	·180	Snow showers A. M., rain P. M.
2 Wednesday, . .	29·578	44	45	43	45	33	N.	8	Do. . .	Do. . . .	·080	Hail showers, very cold.
3 Thursday, . . .	29·578	48	52	50	52	31	W.	9	Do. . .	Do. . . .	·040	Do.
4 Friday, ...	29·728	61	64	63	64	31	W.	9	Do. . .	Do. . . .	. .	Fine, sunshiny day.
5 Saturday, . . .	30·024	54	56	55	56	42	W.	9	Do. . .	Do. . . .	·020	Very fine day.
6 Sunday, ...	30·100	57	59	58	60	41	W.	8	Do. . .	Do. . . .	. .	Fine, breezy day.
7 Monday, ...	30·130	58	62	61	62	43	W.	9	Do. . .	Do. . . .	. .	Do.
8 Tuesday, ...	29·712	53	54	53	55	50	S. W.	0	Do. . .	Do. . . .	·010	Fair A. M., showery P. M.
9 Wednesday, . .	29·700	52	54	52	55	47	N. W.	7	Do. . .	Do. . . .	·080	Heavy showers during day.
10 Thursday, . . .	29·830	58	62	60	62	44	S. W.	9	Do. . .	Do. . . .	. .	Very fine day.
11 Friday, ...	29·374	50	50	48	53	48	W.	2	Do. . .	Do. . . .	·030	Wet, and stormy.
12 Saturday, . . .	29·850	52	55	54	55	45	N. W.	3	Do. . .	Do. . . .	·020	Showery day.
13 Sunday, ...	30·000	50	52	50	53	47	N. W.	4	Do. . .	Do. . . .	. .	Fine, and changeable.
14 Monday, ...	30·140	52	54	53	54	40	S. E.	8	Do. . .	Do. . . .	·010	Fine, breezy day.
15 Tuesday, . . .	30·280	53	54	53	55	35	E.	10	Do. . .	Do. . . .	. .	Fine, sunshiny day.
16 Wednesday, . .	30·214	57	60	59	60	40	S. E.	10	Do. . .	Do. . . .	. .	Do.
17 Thursday, . . .	30·130	58	61	61	62	39	S. W.	10	Few, . .	Do. . . .	. .	Do.
18 Friday, ...	30·030	57	59	58	59	37	S. E.	10	Do. . .	Do. . . .	. .	Do.
19 Saturday, . . .	30·050	62	66	65	66	45	S. E.	10	Do. . .	Do. . . .	. .	Do.
20 Sunday, ...	30·190	63	67	66	67	44	E.	10	Do. . .	Do. . . .	. .	Fine, breezy day.
21 Monday, ...	30·300	61	63	62	63	44	N. E.	10	Do. . .	Do. . . .	. .	Do.
22 Tuesday, . . .	30·290	57	59	58	60	44	E.	10	None, . .	. . . . . .	. .	Do.
23 Wednesday, . .	30·260	55	57	56	57	40	E.	10	Few, . .	Broken, . .	. .	Fine, sunshiny day.
24 Thursday, . . .	29·970	55	58	56	58	38	E.	10	Do. . .	Do. . . .	. .	Strong breeze, fine day.
25 Friday, ...	29·890	54	57	56	58	37	E.	10	Do. . .	Do. . . .	. .	Do.
26 Saturday, . . .	29·878	59	62	60	63	40	E.	10	Many, . .	Do. . . .	. .	Breezy, and changeable.
27 Sunday, ...	29·800	58	61	60	61	39	N. W.	10	Few, . .	Do. . . .	. .	Breezy, fine day.
28 Monday, ...	29·700	57	59	57	61	37	N. E.	10	Many, . .	Do. . . .	. .	Strong breeze, fine day.
29 Tuesday, ...	29·700	58	59	58	59	40	N. W.	10	Do. . .	Do. . . .	. .	Do.
30 Wednesday, . .	29·690	55	58	56	58	35	N. W.	10	Do. . .	Do. . . .	. .	Fine A. M., changeable P. M.
31 Thursday, . . .	29·680	56	58	56	59	42	N. E.	2	Do. . .	Do. . . .	·320	Very wet day.
								255	Total Amount of Rain,		·640	inches.

JUNE, 1866.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Friday, ...	29·700	57	59	57	60	40	N. E.	3	Many, . .	Broken, . . .	·510	Stormy, wet day.
2 Saturday, ...	29·810	60	64	62	64	49	N. E.	9	Do. . .	Do. . . .	·160	Showery A. M., fine P. M.
3 Sunday, ...	29·700	60	64	63	64	50	S. E.	8	Do. . .	Do . . .	·120	Showery day.
4 Monday, ...	29·700	61	65	64	65	51	S. E.	10	Do. . .	Do. . . .	·200	Fine, sunshiny day.
5 Tuesday, ...	29·700	54	57	55	57	49	S.	0	Do. . .	Do. . . .	·410	Very wet day.
6 Wednesday, . . .	29·850	59	63	61	64	53	S.	3	Do. . .	Do. . . .	. .	Fine, but changeable.
7 Thursday, ...	29·850	61	66	65	66	54	S. E.	5	Do. . .	Do, . . .	·200	Mild, and showery.
8 Friday, ...	30·168	68	71	70	71	52	S. W.	10	Do. . .	Do. . . .	. .	Very warm day.
9 Saturday, . . .	29·980	58	61	60	61	52	S. E.	4	Do. . .	Do. . . .	·020	Showery day.
10 Sunday, ...	29·800	65	68	67	68	52	S. W.	10	Do. . .	Do. . . .	. .	Fine, mild day.
11 Monday, ...	29·778	57	59	57	68	53	S. W.	8	Do. . .	Do. . . .	. .	Do.
12 Tuesday, ...	29·780	64	68	66	68	52	S. E.	6	Do. . .	Do. . . .	. .	Do.
13 Wednesday, . . .	29·800	58	61	60	62	50	N. W.	8	Do. . .	Do. . . .	. .	Do.
14 Thursday, ...	29·874	60	64	63	65	53	S. W.	9	Do. . .	Do. . . .	·030	Fine, but changeable.
15 Friday, ...	29·850	62	65	64	65	55	N. W.	10	Do. . .	Do. . . .	·060	Do.
16 Saturday, ...	29·450	55	57	55	58	47	W.	8	Do. . .	Do. . . .	. .	Fine, mild day
17 Sunday, ...	29·750	55	56	55	57	42	E.	4	Do. . .	Do. . . .	·020	Light showers, fine day.
18 Monday, ...	29·350	48	50	48	50	41	N. E.	0	Do. . .	Do. . . .	·070	Stormy, and showery.
19 Tuesday, ...	29·700	55	57	55	57	41	W.	6	Do. . .	Do. . . .	·350	Showery day.
20 Wednesday, . . .	29·650	55	57	55	57	40	S. W.	0	Do. . .	Do. . . .	·750	Very wet day.
21 Thursday, ...	29·750	62	65	64	68	53	S. W.	10	Do. . .	Do. . . .	·500	Heavy rain A. M., fair P. M.
22 Friday, ...	29·920	64	67	66	68	50	S. W.	10	Do. . .	Do. . . .	·100	Showery day.
23 Saturday, ...	30·000	67	71	70	71	55	S. W.	10	Do. . .	Do. . . .	. .	Fine, mild day.
24 Sunday, ...	30·130	68	71	70	72	48	S. E.	10	Do. . .	Do. . . .	·010	Do.
25 Monday, ...	30·130	70	75	74	75	47	S. E.	10	None, . .	. . . .	. .	Fine, sunshiny day.
26 Tuesday, ...	30·050	73	75	74	77	53	S. E.	10	Do. . .	. . . .	. .	Very warm day.
27 Wednesday, . . .	29·992	71	74	73	74	55	N. W.	10	Few, . .	Broken, . . .	. .	Do.
28 Thursday, . . .	30·030	68	72	71	72	54	N. E.	10	None, . .	. . . .	. .	Warm, sultry day.
29 Friday, ...	29·940	68	72	71	73	53	E.	10	Few, . .	Broken, . . .	. .	Do.
30 Saturday, ...	29·480	67	70	69	72	50	S. W.	8	Many, . .	Do. . . .	. .	Dull, and changeable.
								220	Total Amount of Rain,		3·500	inches.

JULY, 1866.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Sunday, ...	29·380	57	59	57	60	47	S. W.	6	Many, . .	Broken, . .	·060	Showery day.
2 Monday, . . .	29·250	56	60	58	60	44	N. W.	8	Do. . .	Do. . . .	·280	Hail showers frequent.
3 Tuesday, . . .	29·200	58	60	58	60	48	S. W.	10	Do. . .	Do. . . .	·120	Do.
4 Wednesday, . .	29·270	57	59	57	59	50	W.	8	Do. . .	Do. . . .	·140	Heavy showers frequent.
5 Thursday, . . .	29·434	56	60	58	60	47	S. W.	8	Do. . .	Do. . . .	·440	Do.
6 Friday, ...	29·712	59	63	61	63	47	N. W.	9	Do. . .	Do. . . .	. .	Fine, but changeable.
7 Saturday, . . .	29·950	57	60	58	60	48	S. W.	0	Do. . .	Do. . . .	·010	Showery, and changeable.
8 Sunday, . . .	29·978	62	66	64	66	58	W.	9	Do. . .	Do. . . .	. .	Do.
9 Monday, . . .	30·050	60	64	62	65	57	S. W.	10	Do. . .	Do. . . .	·010	Light rain, breezy, fine.
10 Tuesday, . . .	30·220	72	76	75	78	59	W.	10	Do. . .	Do. . . .	. .	Fine, mild day.
11 Wednesday, . .	30·240	71	95	74	75	55	S.	10	Do. . .	Do. . . .	. .	Fine, sunshiny day.
12 Thursday, . . .	30·084	71	74	73	75	53	S. E.	10	Do. . .	Do. . . .	. .	Do.
13 Friday, ...	30·000	69	71	69	74	58	S. W.	9	Do. . .	Do. . . .	. .	Do.
14 Saturday, . . .	30·050	58	60	59	73	57	W.	9	Do. . .	Do. . . .	. .	Breezy, and changeable.
15 Sunday, . . .	30·000	69	71	70	72	58	S. W.	10	Do. . .	Do. . . .	. .	Clear sunshine.
16 Monday, . . .	30·200	69	73	72	73	59	E.	10	Few, . .	Do. . . .	. .	Do.
17 Tuesday, . . .	30·010	65	69	68	69	59	N. W.	0	Do. . .	Do. . . .	. .	Dull until afternoon.
18 Wednesday, . .	30·150	70	74	73	74	52	E.	10	Cloudy, . .	Do. . . .	. .	Bright sunshine.
19 Thursday, . . .	30·200	68	72	71	72	56	W.	10	Few, . .	Do. . . .	. .	Do.
20 Friday, ...	30·200	69	72	71	72	54	S. E.	10	Do. . .	Do. . . .	. .	Do.
21 Saturday, . . .	30·250	68	71	70	71	50	S. E.	10	Do. . .	Do. . . .	. .	Do.
22 Sunday, . . .	30·250	68	72	71	72	50	E.	10	Many, . .	Do. . . .	. .	Clear sunshine.
23 Monday, . . .	30·072	65	70	69	70	52	N. E.	4	Do. . .	Do. . . .	. .	Dull, and sultry.
24 Tuesday, . . .	30·150	64	68	67	69	56	N. E.	4	Do. . .	Do. . . .	. .	Gloomy A. M., sunshine P. M.
25 Wednesday, . .	30·228	65	70	69	70	56	N· E.	6	Do. . .	Do. . . .	. .	Do.
26 Thursday, . . .	29·940	63	67	66	69	57	S. E.	2	Do. . .	Do. . . .	. .	Dull, and changeable.
27 Friday, ...	29·650	60	63	61	65	60	S.	0	Do. . .	Do. . . .	·050	Hazy, wet day.
28 Saturday, . . .	29·600	65	68	66	70	58	S. E.	6	Do. . .	Do. . . .	. .	Warm, sultry day.
29 Sunday, ...	29·680	64	68	67	68	58	N. W.	10	Do. . .	Do. . . .	·060	Do.
30 Monday, . . .	29·870	60	65	64	65	50	N.	10	Do. . .	Do. . . .	·030	Strong breeze, fine day.
·31 Tuesday, . . .	29·916	64	68	67	68	45	N. W.	10	Do. . .	Do. . . .	. .	Cloudy, and changeable.
								238	Total Amount of Rain,		1·200	inches.

AUGUST, 1866.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	M. x.	Min.	Direction.		Amount.	Form.		
1 Wednesday,	29·550	59	60	59	61	46	S. E.	0	Many,	Broken,	·030	Breezy, and showery.
2 Thursday,	29·720	61	64	63	65	56	N. W.	4	Do.	Do.	·550	Breezy, and changeable.
3 Friday,	29·720	62	64	63	65	56	N. W.	10	Do.	Do.	·050	Breezy, fine day.
4 Saturday,	29·620	59	61	60	63	49	W.	8	Do.	Do.	·080	Stormy, and showery,
5 Sunday,	29·700	59	61	60	61	47	S. W.	8	Do.	Do.	·080	Strong breeze, light showers.
6 Monday,	29·800	58	60	58	61	49	S. W.	9	Do.	Do.	·060	Do.
7 Tuesday,	29·800	55	58	56	59	50	W.	9	Do.	Do.	·090	Very stormy, and showery.
8 Wednesday,	29·430	57	59	57	59	48	W.	8	Do.	Do.	·120	Do.
9 Thursday,	29·572	58	60	59	61	48	N. W.	8	Do.	Do.	·090	Breezy, and showery.
10 Friday,	29·874	58	60	59	60	47	N. W.	7	Do.	Do.	·040	Do.
11 Saturday,	29·950	60	62	61	64	47	S. W.	8	Do.	Do.	. . .	Fine, breezy day.
12 Sunday,	29·700	60	61	60	62	54	W.	0	Do.	Do.	·270	Dull, and showery.
13 Monday,	29·800	60	63	61	65	51	S. W.	8	Do.	Do.	. .	Dark, and cloudy.
14 Tuesday,	29·930	62	65	64	65	56	N. W.	6	Do.	Do.	. .	Breezy, and changeable.
15 Wednesday,	29·900	62	65	64	65	52	W.	8	Do.	Do.	. .	Do.
16 Thursday,	29·900	61	63	62	64	56	W.	6	Do.	Do.	. .	Do.
17 Friday,	29·850	59	61	60	63	56	W.	8	Do.	Do.	. .	Do.
18 Saturday,	29·730	60	65	62	65	42	S. W.	2	Do.	Do.	. .	Do.
19 Sunday,	29·730	63	66	65	66	40	E.	6	Do.	Do.	. .	Fine, mild day.
20 Monday,	29·750	65	68	67	70	41	E.	9	Few,	Do.	. .	Do.
21 Tuesday,	29·900	66	68	67	71	47	N. E.	10	Do.	Do.	. .	Do.
22 Wednesday,	29·900	63	65	64	67	52	S. E.	8	Many,	Do.	. .	Cloudy, and changeable.
23 Thursday,	29·850	63	67	66	67	59	S. E.	0	Do.	Do.	·080	Breezy, and changeable.
24 Friday,	29·900	68	70	69	71	59	S. E.	7	Do.	Do.	·060	Foggy A. M., fine P. M.
25 Saturday,	29·774	63	66	64	66	60	S. E.	0	Do.	Do.	·380	Very wet day.
26 Sunday,	29·630	65	69	68	71	58	S. E.	8	Do.	Do.	·020	Fine, but changeable.
27 Monday,	29·600	63	66	65	66	54	S. W.	6	Do.	Do.	·030	Do.
28 Tuesday,	29·570	63	67	66	70	57	N.	8	Do.	Do.	·010	Do.
29 Wednesday,	29·570	56	59	57	59	51	N.	8	Do.	Do.	. .	Breezy, and changeable.
30 Thursday,	29·680	62	66	65	67	54	S. W.	6	Do.	Do.	·020	Do.
31 Friday,	29·700	65	67	66	67	57	S. W.	10	Do.	Do.	.	Do.
								188	Total Amount of Rain,		1·980	inches.

1867.

M. H. Gill, Printer to the Royal Dublin Society.

80
31 k.

No. XXXVI.] [Price 2s.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

CONTENTS:

PAGE.
1. Heer on the Miocene Flora of North Greenland, ... 69
2. Dr. Cameron on the Substitution of Rubidia for Potash in Plants, ... 85
3. Dr. Reynolds' Notes on certain Absorption Spectra, ... 89
4. Mr. Foot's Notes on a Tour in Norway in the Summer of 1866, ... 96
5. Dr. Reynolds' Preliminary Notice of the Discovery of an Isomer of Sulphocyanogen, ... 114
6. Dr. Cullen on the Darien Canal Line, ... 117
7. Dr. Reynolds on an Apparatus for the Estimation of Carbonic Acid and the Valuation of Manganese Ores, ... 138
8. Return of Donations to the Royal Dublin Society, ... 140
9. Intelligence, ... 147

Appendix—Meteorological Journal from September, 1866, to April, 1867, . . . i

DUBLIN:
HODGES, SMITH, AND CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.
1867.

HARVARD COLLEGE
AUG 2 1917
LIBRARY

The Society

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

THE Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Registrar:—

Life Membership, ...	£21 0 0
Annual Membership (with £3 3s. Entrance Fee),	2 2 0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15s.

I.—MEETINGS OF THE SOCIETY.

1. *Stated and Ordinary Meetings.*

The Society meets at 3 o'Clock P. M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday in November.

2. *Evening Scientific Meetings.*

Meetings of the Society and of the Associated Societies, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session. The business is conducted in the following sections:—

I. AGRICULTURE and Rural Economy, and Horticulture.

II. FINE ARTS.

III. NATURAL SCIENCES, including Zoology, Botany, Physiology, Mineralogy, Geology, Physical and Descriptive Geography.

IV. EXPERIMENTAL SCIENCES, including Physics, Chemistry, Physiology, Meteorology, and the Mechanical Arts.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society, and in the Quarterly Journal of Science.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5s. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6*d*. each; or to twelve for 5s., available for any of the ordinary Meetings throughout the Session.

THE COUNCIL AND COMMITTEES.

The Council, which comes into office in April, meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

Six Standing Committees are annually elected, as follows:—1. Agriculture; 2. Botany; 3. Fine Arts; 4. Library; 5. Natural History; 6. Practical Science.

[*For continuation, see page* 3 *of Cover.*

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

VII.—*On the Miocene Flora of North Greenland.* By PROFESSOR OSWALD HEER. Translated by ROBERT H. SCOTT, M. A.

[Read November 19, 1866.]

I HAVE the honour to submit to the Society the following account of the results of my examination of the valuable collection of fossil plants which have been intrusted to me. I feel that I can hardly sufficiently express the deep obligation which I feel to the Society for the facilities which it has afforded me for the prosecution of my investigations into the Fossil Flora of the Tertiary epoch. This collection has been brought from the Arctic Regions by Captain Philip H. Colomb, R. N., and Sir F. Leopold M'Clintock, R. N., and presented by these gentlemen to the Museum of Natural History.

Before the arrival of these specimens, Dr. J. D. Hooker had intrusted to me some which had been presented to the Museum at Kew by Dr. Lyall and Dr. Walker. In this latter collection I discovered seven determinable species, which are also to be found among the specimens of the Dublin collection. In this I find sixty-three recognisable species. If we add to these the additional species mentioned by Brongniart and Vaupel, we obtain a total of sixty-six species.

All the specimens of the Dublin and Kew collections come from Atanekerdluk, as do also those which Capt. E. A. Inglefield brought home, of which he deposited a portion in the Museum of the Geological Survey in Jermyn-street, and retained a portion in his own hands. The former have been kindly sent to me by Sir R. I. Murchison, while I have obtained the latter through the goodness of their owner.

Atanekerdluk lies on the Waigat Strait, opposite Disco, in lat. 70° N. A steep hill rises on the coast to a height of 1080 feet, and at this level the fossil plants are found (Pl. II.). Large quantities of wood in a fossilized or carbonized condition lie about. Capt. Inglefield observed one trunk, thicker than a man's body, standing upright. The leaves, however, are the most important portion of the deposit. The rock in which they are found is a sparry iron ore, which turns reddish-brown on exposure to the weather. In this rock the leaves are found, in places packed closely together, and many of them are in a very perfect condition. They give us a most valuable insight into the nature of the vegetation which formed this primæval forest.

The catalogue which I append to this paper will give a general idea of the Flora of this forest of Atanekerdluk; but, before we proceed to discuss it, I must make a few remarks.

I. *The fossilized plants of Atanekerdluk cannot have been drifted from any great distance; they must have grown on the spot where they are found.*

This is proved,

α. By the fact that Captain Inglefield and Dr. Rink observed trunks of trees standing upright.

β. By the great abundance of the leaves, and the perfect state of preservation in which they are found. Timber, hard fruits, and seeds may often be carried to a great distance by ocean currents, but leaves always fall to pieces on such a long journey, and they are the more liable to suffer from wear and tear, the larger they are. We find in Greenland very large leaves, many of which are perfect up to the very edge. It is, however, difficult to work them out from a stone which splits very irregularly, and consequently we can hardly exhibit the entire leaves in a perfect condition.

γ. By the fact, that we find in the stone both fruits and seeds of the trees whose leaves are also found there. Thus, of ***Sequoia Langsdorfii*** we see not only the twigs covered with leaves, but also cones and seeds, and even a male blossom-catkin; of ***Populus***, ***Corylus***, ***Ostrya***, ***Paliurus***, and ***Prunus***, there are leaves and some remains of fruit, which could not be the case if the specimens had drifted from a great distance.

δ. By our finding remains of insects with the leaves. The instances I have noticed are the elytron of a small beetle, and the wing of a good-sized wood-bug, belonging probably to the family of the ***Pentatomidæ***.

II. *The Flora of Atanekerdluk is Miocene.*

Of the sixty-six species of North Greenland, eighteen occur in the Miocene deposits of Central Europe; nine of these are very widely distributed both as to time and space, viz.:—

Sequoia Langsdorfii,
Taxodium Dubium,
Phragmites Œningensis,
Quercus Drymeia,
Planera Ungeri,
Diospyros brachysepala,
Andromeda protogæa,
Rhamnus Eridani,
Juglans acuminata.

These are found both in the Upper and Lower Molasse, while some species, viz.,

Sequoia Couttsiæ,	Corylus Mac Quarrii,
Osmunda Heerii,	Populus Zaddachi,

have not as yet been noticed in the Upper Molasse. From these facts it seems probable that the fossil forest of Atanekerdluk flourished in that high northern latitude at the Lower Miocene epoch.

III. *The Flora of North Greenland is very rich in species.*

This is evident from the great variety of vegetable forms which have been discovered in the specimens submitted to me. Although the material which has come under my observation is of considerable extent, it cannot be compared with the immense stores of specimens which have been obtained from our Swiss localities, *e. g.* from Monod or Hohe Rhonen, or even from Œningen.

Atanekerdluk has only been visited on two or three occasions; and the examinations then carried out, which were at best merely cursory, have only given us a glimpse of this wondrous Arctic forest, which doubtless contains in its storehouses treasures of exceeding richness, awaiting diligent and scientific research for their discovery. How true this is appears from the fact, that in some slabs of moderate size, five or six, and in one instance even eleven, different fossil specimens are to be found, proving the great variety of the timber which formed this wood. We should remember, also, that the Brown Coal Formation appears in Disco and Hare Islands on a very large scale; so that we may fairly expect that fossil trees are to be found in close proximity to these deposits. In fact, Professor Göppert describes three fossil plants from Kook, in lat. 70° N.—*Pecopteris borealis, Sequoia Langsdorfii,* and *Zamites Arcticus,*— which very remarkable species he has described in his "*Jahrbuch für Mineralogie,*" 1866 (p. 134).

IV. *The Flora of Atanekerdluk proves without a doubt that North Greenland at the Miocene epoch had a climate much warmer than its present one.*

The difference between its former and present temperatures amounts to nearly 30° F. At least, it is only by an elevation of the annual temperature of the region to about this extent, that the existence of this fossilized forest becomes intelligible to us. At the time when we sought, from the evidence afforded by the Fauna and Flora of the Miocene Formation, to establish the fact that at that epoch the climate of Switzerland must have been subtropical, the conclusions were disputed by many persons. It was urged that the Tertiary types of plants, which correspond to those now flourishing in the temperate and torrid zones, might have existed at a temperature much lower than is possible for their living relations or descendants. Inasmuch as the results at which we arrived had been obtained, not from the consideration of a few species, but from that of a whole series of phenomena, exhibiting the most absolute mutual dependence and correlation, we could not attach much weight to objections such as those alluded to.

They lose their entire significance when we come to look at the Flora of Greenland.

The mere fact of the occurrence in Greenland, in lat. 70° N., of a fossilized forest, is in a high degree remarkable, inasmuch as trees do not grow at all in Greenland at the present day; but our astonishment is still more aroused when we see what the trees were which composed this forest. We find in it, not only poplars, birches, and firs, which are found at present as forest trees, though not in Greenland, yet in North Canada and Lapland, within the limits of the Arctic zone, but numerous kinds of trees and bushes, whose living homologues are not met with until we reach a latitude 10° or 20° to the southward. Thus, we find two *Sequoias* (*S. Langsdorfii*, and *S. Couttsiæ*), which are now represented only in California; one *Salisburea*, the nearest forms to which are found in Japan; three *beeches*, and four *oaks*. Of the latter, one (*Q. Drymeia*) had evergreen foliage; another (*Q. greenlandica*), fine leaves, six inches long, like those of the American swamp-chesnut-oak (*Q. Prinus* L.); a third species (*Q. Olasseni m.*) had leaves like these, while the fourth (*Q. atava m.*) reminds us of the German oak (*Q. robur* L.); but the *plane tree*, a *Magnolia* (*M. Inglefieldi*), a *walnut* (*Juglans acuminata*), an evergreen *cherry* (*Prunus Scottii*), a *Planera* (*P. Ungeri*), and a *Persimmom* (*Diospyros brachysepala*), took part in the formation of this wood. Without a doubt, the *ivy* (*Hedera Mac Clurii*) clothed these trees, while the *hazel* (*Corylus Mac Quarrii*), two *Christ's thorns* (*Paliurus Colombi*, and *P. borealis*), a *buckthorn* (*Rhamnus Eridani*), and an *Andromeda* (*A. protogæa*) formed the underwood. In the shady parts it is evident that the *bracken* (*Pteris Rinkiana*), and an *Osmunda* (*O. Heerii*) clothed the surface with their feathery fronds; while on the foliage of the trees we find that lichens had established themselves, and covered the leaves with bright coloured specks and blotches. The *Osmunda*, a *buckbean* (*Menyanthes Arctica*), and the *wood cypress* (*Taxodium dubium*) prove the existence of marshy grounds, to which the brown coal deposits of North Greenland most probably owe their origin.

These are all well-known existing genera; and the Miocene types are, for the most part, so similar to those now existing, that we may regard them as their progenitors, their homologues.

To these we must add some forms which are quite new and peculiar, and whose generic relationships are as yet undecided. The most important are a *Daphnogene* (*D. Kanii*), the genus *M'Clintockia*, and a *Zamites*. The Daphnogene must have been a tree or shrub, with round leaves, which with the stalk were nearly a foot in length, and were thick and leathery in texture, so that the plant was probably evergreen. They resemble in form and nervation the leaves of the Indian cinnamon, but differ from them in one material character, so that they appear to belong to a distinct generic type. Under the name *M'Clintockia* I have placed three leaf forms, which are remarkable in respect of their longitudinal nervation running to three or seven points, their beautifully delicate vein network, and their dentation. They present to us a peculiar type of vegetation, hitherto unknown, but probably belonging to the family of the Proteaceæ. The *Zamites arcticus* of Göppert had leaves divided into small narrow spikes, and seems to have grown to the size of small trees. As long as we are unable to recognise any living species analogous to the Daphnogene, the M'Clintockias, and the Zamites, we are precluded from basing on them any accurate reasoning respecting their climatal character; but thus much may be assumed without fear of contradiction, viz., that plants with large leathery evergreen foliage, like Daphnogene and the M'Clintockias, could never have existed in a cold climate.

If now we take a general view of that portion of the whole Flora which may be considered as closely allied to existing types, and seek to ascertain the extreme northern limits at which these plants grow at the present day—not only their natural limits, but even those attainable by artificial culture—we find that, on an average, these plants grow in a latitude about 12° to the southward, under the most favourable circumstances. In reality, however, the difference was much more serious. We must not omit to notice that the plants which we have found at Atanekerdluk were by no means all of them at their extreme northern limit.

The Flora of every country is composed of a congeries of plants, some of which are in the central portion of their region, others again at the northern, and others at the southern limit of their distribution. This was clearly the case at the Miocene epoch also; and the sixty-six plant forms which we have hitherto discovered in North Greenland afford unmistakeable proofs of such a mixture. It is probable that the *Sequoia Langsdorfii* and *Couttsiæ*, the *Salisburea*, the *Quercus Drymeia*, *greenlandica*, and *Olasseni*, the *Planera Ungeri*, and *Paliurus Colombi*, were nearly at their northern limit in 70° latitude. In the case of the fir, birch, poplar, willow, hazel, *Quercus atava*, beech, plane, and walnut, this was certainly not the fact; for we know well that the analogous living representatives of these genera reach to a latitude many degrees more northerly than the first-mentioned trees.

We get a proof of the correctness of this statement from an examination of the Miocene Flora of Spitzbergen. I am indebted to the kindness of Professor Nordenskiold for the opportunity of carrying this out, as he has intrusted the series of specimens to me. Here we find in lat. 78° N. the beech, plane, hazel, a poplar (*Populus Richardsoni*), a fir, and the Taxodium of Greenland; while in lat. 79° N. we find a lime and a poplar (*Populus arctica*). In the present time the firs and poplars reach a limit 15° to the north of the artificial limit of the plane, and 10° to the north of that of the beech; so that we cannot doubt but that the firs and poplars which we find in the forest of Atanekerdluk, and at Bell Sound, Spitzbergen, reached up to the North Pole itself, in so far forth as there was dry land in those latitudes at the Miocene epoch. Accordingly, the hills of fossilized wood which were observed by Captain M'Clure and Dr. Armstrong in Banks' Land, lat. 74° 27′ N., should cause us no astonishment. They only confirm the fact, that the Polar Regions were once clothed with forests, where now we find nought but vast deserts of ice, scarce affording a chance for any vegetation to exist.

It is clear that the climate of the Polar Regions at the Miocene epoch must have been much warmer than at present, in order to render it possible for forty-three genera of trees and shrubs to have existed there; but it is not an easy matter to express this fact numerically, as the life and the distribution of plants are dependent on many and various conditions. The assumption which I make, viz., that North Greenland possessed at the Lower Miocene epoch, in lat 70° N., a mean annual temperature nearly 30° F. higher than its present one, is based on a comparison of the limits of distribution of the existing homologous species. This investigation runs to too great a length for me to include it in the present paper.* A single instance will be sufficient to show the nature of the reasoning.

Sequoia Langsdorfii is the commonest tree at Atanekerdluk; sprigs of it occur in almost every slab. This shows us that it must have been very abundant in the forests of which we find the remains. It is met with also at the Mackenzie River, lat. 65° N., at the Rocky Mountains, and even on the promontory of Taketschek, on the western shore of the Gulf of Kena. Hence we see that it was a tree very widely distributed in northern regions.

It is, however, by no means limited to these latitudes; for we find it throughout Europe, from the Amber district of the Baltic down to Central Italy (Senegaglia). The twigs, leaves, and fruit cones prove to us that the tree which is found at Atanekerdluk belongs to this very species. It is so closely allied to the *Sequoia sempervirens* of Lambert (the "Redwood," that we may consider the latter as its lineal descendant. In fact, the slight differences which exist between them are hardly sufficient to establish a specific distinction. Accordingly, this, the chief tree of the forest of Atanekerdluk, is especially qualified to elucidate the climatological conditions of the region.

The *Sequoia sempervirens* forms great forests in California, and extends from Mexico to the forty-second degree of latitude. In North-Western British America it is no longer met with. In Europe, however, this beautiful tree reaches a far higher latitude by means of artificial cultivation. It flourishes in the gardens and pleasure grounds of Upper Italy, and ripens its fruit every year at Bellagio, on the Lake of Como. To the north of the Alps the same fact is observed at Lausanne (on the Eglantine). In Zürich it lives out the winter in the open air, but has not as yet produced fruit. In Southern Germany it grows at Stuttgart; but at Berlin the efforts to rear it have been fruitless, as it is killed by the frosts in winter. The same happened in the south of Sweden.

---

* It will be contained in my "Fossil Flora of the Polar Regions," in which the fossil plants which have been discovered in N. Greenland, Melville Island, Banks' Land, at the Mackenzie River, in Iceland, and Spitzbergen, will be described and figured. I hope to be able to bring out this work ere long.

In France it succeeds well at Paris, but the blossom buds are often killed by frost, so that no fruit sets.

In Ireland there are some fine trees to be seen about Dublin, and near London it grows well, but I have not been able to ascertain whether it ripens its flowers and fruit in these localities. Accordingly, we may probably place the northern limit of its distribution at the parallel of 54° N. in the British Islands, while it scarcely reaches that of 52° in North Germany. We may, therefore, fairly set the mean northern limit at the parallel of 53° N.

The following Table shows us the temperatures of the stations on the limiting line, and of other points which lie near it, but still are outside the district, taken from Mahlman's Tables:—

Sequoia Sempervirens.	Latitude.	Temperature.						
		Year.	Winter.	Spring.	Summer.	Autumn.	Warmest Month.	Coldest Month.
ON THE BOUNDARY.								
Lausanne, . .	46° 31′	49°·1	32°·9	48°·5	65°·1	49°·8	65°·6	31°·8
Paris, ...	48 50	51·4	38·1	50·7	64·6	52·2	65·6	35·4
Near London, .	57 36	49·2	37·6	48·2	61·5	50·0	63·1	35·0
Dublin, . . .	53 23	49·1	40·3	47·1	59·5	49·6	60·8	39·8
OUTSIDE IT.								
Edinburgh, . .	55 57	46·6	38·5	45·3	57·0	46·2	58·2	37·0
Berlin, ...	52 31	47·2	31·8	46·2	63·0	47·6	64·4	29·9
Stockholm, . .	59 21	42·1	25·5	37·9	61·0	43·7	63·6	23·9

Hence we see that *Sequoia sempervirens* requires for its existence a summer temperature of at least 59 or 60°, and for the ripening of its fruit and seeds one of about 64°. The winter temperature must not fall, in the coldest month, below 31°, and the annual temperature must be about 49°. We may, therefore, set its limit at about the isothermal of 49° F. *Sequoia Langsdorfii* would require conditions of climate similar to these; and as we find that it was such an important member of the group of trees which grew at Atanekerdluk, that it blossomed and ripened its fruit and seeds there, we must assign to North Greenland in the Miocene age a climate similar to that which we have described.

The majority of the other plants give us results similar to the above, inasmuch as their closest allies or descendants in part reach the same northern limit as Sequoia, and in part stretch even further to the northward. The *Daphnogene*, *Hakea*, *M'Clintockias*, *Zamites*, *Callistemophyllum*, and the *Ficus* (?) *greenlandica* have a more southern character. Until we can point out living forms analogous to these, we cannot rest on them as much weight as on the former groups; but yet we evidently learn from them that the assumption of a mean annual temperature of 49° is the very lowest at which this Flora could exist, and this warns us to devote our attention to these plants in particular, in order to determine their nearest relations in the existing creation.

At present, North Greenland at the parallel of 70° N. has an annual temperature of about 20°; this gives us a difference of about 30° in round numbers. According to Dove, the normal annual temperature of this parallel is 16° F.; so that the temperature of North Greenland is higher than this; and we find much warmer climates in the same latitude further to the eastward.

The Altenfiord lies in the same latitude (70° N.), as Atanekerdluk, and has a mean annual temperature of 33°; but even this is 16° lower than that which we must assume as the temperature of this latitude in the Miocene age. These results agree very well with those which we have obtained, when we determined the climatological conditions of Central Europe during the Miocene epoch.* They show us that the hypothesis put forward by Professor Sartorius von Waltershausen is at variance with facts which are incontrovertible. He attempts to prove that an extreme insular climate for the land would explain all the phenomena of organic nature in the Tertiary epoch, and to this end has calculated for the various parallels of latitude the temperatures which would be obtainable by these means. For the parallel of 70° N., i. e. for our locality in North Greenland, he gets the isothermal of 39° 4, and the temperature of 48° 5, in the warmest, and of 30° 3 in the coldest month. There are many regions on the globe which are well wooded, and which lie under the isothermal of 39°; but, as far as I know, there is not a single tree of any size in a country whose warmest month is only 48°. In the north of Norway we do certainly meet with some birches and aspens up to latitude 71°, with a temperature of 46° 4; but they exist only as dwarfed shrubs. Professor Sartorius has entirely forgotten that a certain degree of warmth is requisite for the development of the vegetation of forest trees, and that a relatively warm winter cannot compensate for the coldness of the summer. With a Miocene climate such as Sartorius has calculated for the parallel of 70° N., nothing but dwarfed poplars and birches would grow—not even the firs and hazels, not to mention the Sequoias, walnuts, oaks, beeches, planes, &c. At the present day, Reikiavik in Iceland, in latitude 64° 8 N., has precisely the mean annual temperature which Sartorius assigns to the parallel of 70° in the Miocene age. The coldest month is 1° colder, but the summer is many degrees warmer, as the warmest month has a temperature of 58°, being an excess of about 9°. Thus we see that Iceland at present is in a position much more favourable for the growth of forests than North Greenland in the Miocene age in lat. 70°, as Sartorius would have us to imagine it at that parallel.

---

* See my "Récherches sur le Climat et la Végétation du Pays Tertiaire," p. 193.

The contrast between Iceland with its treeless wastes, and miserable shrubby birchbushes, and the Miocene forest of North Greenland, is very striking. It is true that in Iceland there are many circumstances unfavourable to the growth of trees; but then we have the north coast of Norway, the region which is more favoured in its situation than any other spot in the northern hemisphere. Here we have the warming influence of the Gulf stream tempering the severity of the winter on the one hand, and on the other the proximity of a continent to the southwards raising the temperature of the summer months. Nowhere do we find the isothermals stretching so far to the north as here; so that, as before remarked, we have in lat. 70° a mean temperature of 33°, the isothermal of 50°, and a temperature of 53° 6′ in the warmest month; and yet here we find only the fir, aspen, and birch, and even these only in a dwarfed state of growth; whereas the fossilized forest of Atanekerdluk exhibits thick trunks of trees, and we have already discovered therein forty-three species of trees and shrubs, whose representatives are now for the most part only to be met with in the temperate zone.

I think these facts are conclusive; and they are still more so when we remember that they are not isolated, but are confirmed by the evidence derivable from the Miocene Flora of Iceland, Spitzbergen, and North Canada. These conclusions, too, are only links in a grand chain of evidence, which presents itself to us in the consideration of the Miocene Flora of the whole of Europe. They show us that it is impossible, by any rearrangement of the relative positions of land and water to produce for the northern hemisphere a climate which would explain the phenomena in a satisfactory manner. We must only admit that we are here face to face with a problem whose solution, in all probability, must be attempted, and we doubt not completed, by the astronomer.

CATALOGUE OF THE SPECIES OF PLANTS HITHERTO DISCOVERED IN NORTH GREENLAND, IN LAT. 70° N.

CRYPTOGAMS.

Fungi.

1. Sphæria Arctica (*m.*)
2. „ annulifera (*m.*)
3. Rhytisma (?) boreale (*m.*)

Filices.

4. Pteris Rinkiana (*m.*)
5. Pecopteris borealis (Brong., "Hist. des Veget. foss.," 1., p. 351, Pl. CXIX., Fig. 14).
6. „ arctica (Brong. *l. c.*, Fig. 13).

7. Osmunda Heerii (Gaudin, "Flor. Tert. Helv.," III., p. 155.

Equisetaceæ.

8. Equisetum boreale (*m.*)

PHANEROGAMS.

Cycadeæ.

9. Zamites arcticus (Göpp. "Neues Jahrbuch für Mineralogie," 1866, p. 134).

Cupressineæ.

10. Taxodium dubium (Sternb. sp. "Heer, Fl. Tert. Helv.," I., p. 49).

Abietineæ.

11. Pinus hyperborea (*m.*)
12. „ sp.
13. Pinites Rinkianus (Vaupel, Rink, North Greenland, p. 62).
14. Sequoia Langsdorfii (Br. sp. Heer, "Fl. Tert. Helv.," I., p. 54).
15. „ Couttsiæ (Heer, "The Lignite of Bovey Tracey," p. 33).

Taxineæ.

16. Taxites Olriki (*m.*)
17. Salisburea borealis (*m.*)

Gramineæ.

18. Phragmites Œningensis (A. Br., Heer, "Fl. Tert. Helv.," I., p. 64).
19. Poacites sp.

Cyperaceæ.

20. Cyperites Zollikoferi (Hr. ?) "Fl. Tert. Helv.," I., p. 76).

Irideæ.

21. Iridium greenlandicum (*m.*)

Salicineæ.

22. Populus Richardsoni (*m.*)
23. „ Zaddachi (Heer, Zaddach "Über die Bernstein-und Braunkohlenlager des Samlandes," p. 4).
24. „ Gaudini (Heer ? "Fl. Tert. Helv.," II., p. 24).
25. „ arctica (*m.*)
26. Salix greenlandica (*m.*)
27. „ Raeana (*m.*)

Betulaceæ.

28. Betula (?) calophylla (*m.*)

Cupuliferæ.

29. Ostrya Walkeri (*m.*)
30. Corylus M'Quarrii (E. Forbes sp.), (Alnites) Corylus grosse dentata Heer, "Fl. Tert. Helv.," II., p. 44).
31. Fagus Deucalionis (Unger, "Chloris protog.," p. 101).
32. „ castaneæfolia (Ung. *l. c.*, p. 104).
33. „ dentata (Goepp? "Palæontog." II.; Ung., "Flora von Gleichenberg," p. 19).
34. Quercus Drymeia (Unger, "Chloris protog.," p. 118).
35. „ Olasseni (*m.*, "Fl. Tert. Helv.," III., p. 119).
36. „ greenlandica (*m.*)
37. „ atava (*m.*)

Ulmaceæ.

38. Planera Ungeri (Ett. "Foss. Fl. von Wien.," p. 14).

Moreæ.

39. Ficus (?) greenlandica (*m.*)

Plataneæ.

40. Platanus aceroides (Göpp., Hr., "Fl. Tert. Helv." II., p. 71).

Laurineæ.

41. Daphnogene Kanii (*m.*)

Proteaceæ.

42. Hakea (?) arctica (*m.*)
43. M'Clintockia dentata (*m.*)
44. M'Clintockia Lyallii (*m.*)
45. „ trinervis (*m.*)

Ericaceæ.

46. Andromeda protogæa (Ung. "Fl. Tert. Helv.," III., p. 8).

Ebenaceæ.

47. Diospyros brachysepala (A. Br., "Fl. Tert. Helv.," III., p. 11).

Gentianeæ.

48. Menyanthes Arctica (*m.*)

Oleaceæ.

49. Fraxinus denticulata (*m.*)

Rubiaceæ.

50. Galium antiquum (*m.*)

Magnoliaceæ.

51. Magnolia Inglefieldi (*m.*)

Araliaceæ.

52. Hedera M'Clurii (*m.*)

Myrtaceæ (?).

53. Callistemophyllum Moorii (*m.*)

Büttneriaceæ.

54. Pterospermites integrifolius (*m.*)

Rhamneæ.

55. Paliurus Colombi (*m.*)
56. ,, (?) borealis (*m.*)
57. Rhamnus Eridani (Ung., Hr., "Fl. Tert. Helv.," III., p. 81).

Juglandeæ.

58. Juglans acuminata (A. Br., Hr., "Fl. Tert. Helv.," III., p. 88).

Amygdaleæ.

59. Prunus Scottii (*m.*)

Incertæ sedis.

60. Phyllites Liriodendroides (*m.*)
61. ,, membranaceus (*m.*)
62. ,, lævigatus (*m.*)
63. ,, Rubiformis (*m.*)
64. Carpolites sphærula (*m.*)
65. ,, lithospermoides (*m.*)
66. ,, bicarpollaris (*m.*)

At the conclusion of the paper, Mr. Scott made the following remarks:—

I am indebted to the kindness of the Assistant Secretary, Dr. Steele, for the drawings of three of the principal leaf forms described, which have been copied from Heer's work, "Flora Tertiaria Helvetiæ." Dr. E. Perceval Wright has also been so kind as to lend a map of the circumpolar regions, which illustrates the localities mentioned in the paper.

I have myself obtained from Captain Inglefield and Captain Colomb extracts from their respective diaries, which I shall now read:—

EXTRACT FROM PRIVATE JOURNAL OF CAPTAIN E. A. INGLEFIELD.

"*July*, 1854.—Came to in a snug anchorage at Atenekerdluk, at 5 P. M., and lost no time in proceeding to the petrified forest spoken of by Rink, and only visited by him some years ago.

"As no European before or since had seen the remains of this forest, it was deeply interesting; and after a tedious walk up a hill swarming with mosquitoes, we reached the spot, 1084 feet above the level of the sea. Petrified trees in many stages were discovered, imbedded in a sort of sandy conglomerate.

"There had been discovered before pieces of wood, &c., but nothing like leaves, or any materials by which the nature of the forest could be ascertained; but we were lucky enough to find a spot where vast quantities of fossilized foliage were deposited, and in nearly every specimen the character of the leaf was clearly and beautifully defined. The fir, pine, beech, and other trees known now only in the temperate zone, were clearly indicated by these specimens of their foliage massed together, as leaves are seen in an English forest after autumn winds have shaken them from the branches, and winter snows have frozen them into a cake. We have collected a great many beautiful specimens—each fibre of each leaf, and the serrated edges, as perfect as though the wind had just shaken it from the bough, though probably that time was long before the days of Noah.

"A perfect stem, standing four feet out of the side of the hill in a sloping direction, was reported by our native guide as being in the neighbourhood of the spot we were examining. I determined upon attempting to reach it, though it was at the brink of a crumbling precipice; and, as no one else cared to venture, I reached it with considerable difficulty alone, and narrowly escaped being precipitated below. At an angle of about 15°, and sloping to the N. E., stood a trunk, larger than my body in girth, and in very tolerable preservation, apparently semi-charred. I was well repaid for the exertion and the perilous climb. Wood in all stages of petrifaction was scattered about, and some pieces found which seemed barely to have altered their original condition; whilst others, retaining all the character of wood in grain, etc., yet were literally coal. We returned on board, laden with specimens, at half-past eight o'clock.

"At 7 A. M. weighed anchor, and proceeded with 'Talbot' in tow across the strait to *Rittenbenk's Kolbrund.* At 11 I went on shore, and soon found a rich deposit of coal, within a few feet of the beach. Not having satisfied myself of the full value of the vein by 12 o'clock, I returned on board, that the men might get their dinner, and afterwards explored the coast to the northward and westward; and shortly fell in with strata from five to six feet in thickness, extending along the beach as far as I could see: this coal seemed of excellent quality, and much resembles anthracite.

"I think we got altogether from this mine about 80 tons.

"The engineer afterwards sent in a report of the qualities of this coal."

EXTRACT FROM JOURNAL OF CAPTAIN P. H. COLOMB.

"*July 7th*, 1854.—After a hot walk, during which we were very much annoyed by mosquitoes, we arrived at the foot of a sharp peak, elevated 1080 feet above the sea. The ground over which we walked was covered with the Arctic willow, interspersed with numerous flowering plants. Except in the deep crevices there was not a particle of snow to be seen, and all the hills were beautifully verdant. This shore is much more forward in its vegetation than the opposite one of Disco, owing, I presume, to its being exposed to the rays of the noonday sun, while the opposite shore only catches a glimpse of it in the morning and evening. We found the peak to which we had been directed to be composed of strata of coal and sandstone, the coal being of a brownish colour, and of slaty formation, breaking up into thin flakes the moment it was handled.

"Scattered about at the foot of this cliff were numbers of pieces of broken up, charred wood; these pieces had a bituminous appearance, although every grain and fibre of the wood was distinctly marked. But the most curious substance which we discovered there was a sort of brownish stone, which upon closer inspection proved to be made of leaves of various kinds, closely pressed together, and petrified in that state.

"At 7 A. M. on the 8th we weighed, and proceeded across the Waigat to a place named in Rink's chart *Rittenbenk's Kolbrund*, where a very large vein of coal was said to exist. At 11 A. M. we got off this place, and found a vein of tolerable coal, about five feet in thickness, extending all along the shore, parallel to, and only about twelve feet above the level of the sea. This vein formed the base of a long range of low cliffs, and was only twenty or thirty feet inland."

Captain Colomb has sent me, in addition to this extract from his Journal, a water-colour sketch of Atanekerdluk (Plate II.), a sketch of cliff at Rittenbenk's Kolbrund (Plate III.), and a tracing of the Admiralty Chart of the district. From this chart I have prepared the map which I exhibit, and which I have coloured geologically by means of information derived from Sir C. Giesecke's MS. Journal. It will be remembered that this copy of the Journal has been procured by the Society from Copenhagen. Sir C. Giesecke spent two or three years at Godhavn, in Disco, and his geological description of the island and surrounding coast is very full. Disco is composed of trappean rocks, with beds of sandstone and of brown coal on the N. E. coast. These rocks rest on gneiss, and in fact the town of Godhavn is on a gneiss island close to Disco.

The country to the southward is all gneiss and granite, so that the Greenlanders have an absurd tradition that Disco has been towed down Davis's Strait by a wizard, who dropped it in the spot where it now lies. However, the same formation occurs at Hare Island, a small islet lying to the north. This has received its name from a blunder of the Dutch whalers, who had mistaken the Arctic foxes, which were very common on the island, for hares. The alternation of brown coal and sandstone is also noticed by Sir C. Giesecke in the Noursoak Peninsula. He expressly states that the line of contact between the trap with the coalbearing sandstones and the gneiss runs across this peninsula from Atanekerdluk to a place called Koom, or Kook, on the south shore of Omenak Fiord. This must be the place whence Professor Goeppert's specimens, referred to in the paper, have come; it is well known to be a locality for brown coal. At Kook the coal rests on gneiss, and alternates with sandstone. The portion of Sir C. Giesecke's Journal which refers to the district is as follows: the reference is p. 480, in the sixth year.

"*July* 17, 1811.

"The coal mine at Rittenbenk's Kulbrund is the richest and best of all those which I have seen in this country. It is for the most part good pitch coal, resting on and interstratified with sandstone, in several beds of different thicknesses. The largest is about six or eight feet thick; and the smallest, which lies at the bottom, is rather more than six inches in depth. In the sandstone, at the base of all, there are impressions of leaves of plants, apparently those of the *Angelica Archangelica.*

"The sea, which is very rough here in S. W. storms, as I was unfortunate enough to see, injures the deposit to a great extent, as it is within reach of the waves. As there is no good harbour along the whole of the Waigat, there will be always a good deal of difficulty in shipping the coal after it has been won. As for the character of the workings, I cannot report more than that you would say that pigs had been rooting at the place.

"*July* 18.—In my walk to-day I noticed that the sandstone in the mountains reaches up to the trap tuff, and in the lower parts seems to lie on it, for we can see fragments of the trap in the sandstone. Above this very fine grained trap tuff, which contains igloite (arragonite), the so-called asbestiform zeolite, and occasionally analcime, there rises a vertical cliff of massive basalt, ending to the westward in some slender isolated pinnacles. This basalt is quite free from any admixture of foreign substances, except a few specks of zeolite. Towards midnight I went to my tent.

"*July* 19.—We started at nine in the morning. In the course of yesterday and the day before I had had the skin covering of my umiak [canoe] and its broken keel stitched together with thongs. In this wretched vessel I crossed the Waigat to Mannik, my encampment, four miles from this on the mainland. Three Greenlanders' huts stood there already. The geological structure of the whole line of shore of the mainland, or of the east coast of the Waigat, is just the same as that of Disco, or of the west coast of the strait.

"The sandstone strata appear on the east coast at Noursak, on the seashore, and continue without interruption down to Imnarsoit, one mile to the north of Gamle Rittenbenk; this is a distance of six or eight miles. The trap rocks at times rest on it, and at times appear behind it. In the great valley which stretches up into the mainland between Imnarsoit and Gamle Rittenbenk, and extends, except where interrupted by the iceblink, to Koomes coalmine, on Omenak's Fiord, we lose the trap altogether; and from Gamle Rittenbenk to the southward we find the primitive granite of the district, which is very coarse-grained in this locality.

"At Atanikerdluk [*sic*] very good white fine-grained sandstone occurs in considerable quantity, interstratified with columnar basalt. With the exception of one spot near Noursak [Noursame], there are only rarely found traces of coal in this great development of sandstone. The low land is covered with alluvium, and on this some plants and moss grow.

"From Mannik we came to Kadlu, where there are remains of houses. From this to Atanikerdluk, a spot formerly inhabited, and then to Imnarsoit, two miles.

"Atanikerdluk is a headland composed of massive basalt, which looks like an aggregate of long slender sacks. Imnarsoit consists of columnar basalt. In both cases the rock is free from other minerals. There is a desperate current here. A few rocks lie off Imnarsoit in the sea. Between these two headlands or points lies Tartonak; at this place a little brown coal occurs in beds in sandstone, in a stream bed a little up from the shore. With it alternates a kind of slate, which is found also on Disco Island, at Makkak, and Iglytsiak. It has a brown streak, and marks paper."

As regards the coal of the region there is the following mention in Inglefield's "Summer Search after Sir John Franklin"*:—

After describing the structure of Disco Island, he says—

"From the researches of Dr. Rink, an enterprising Danish traveller, we learn that coal and sandstone are abundantly met with on the S. E. and N. E. shores of Disco Island, the north shore of Waigat Strait, the south shore of Omenak's Fiord, Hare Island, and an island in the North-East Bay, and on the coast on the seventy-second parallel, a few miles southward of the settlement of Proven. Of the purity of this coal, and of its value as fuel, we may judge from the following analysis, which was performed by Professor Fyfe, of King's College, Aberdeen, upon a specimen sent home from Disco Island, by some of the officers of Sir E. Belcher's expedition:—

Its specific gravity is 1·3848.

Volatile matter,		50·60
Coke	Ash,	9·84
	Fixed Carbon,	39·56
		100·00

The coal atHare Island is remarkable for being very full of amber; and this occurs also in the beds of bituminous wood, as stated by Giesecke.

With reference to the coal mine at Rittenbenks Kolbrund, Sir F. M'Clintock ("Voyage of the Fox," p. 28,) gives the following statement:

"After running about twenty-four miles, towards evening we approached a low range of sandstone cliffs on Disco shore, in which horizontal seams of coal were seen. Here we anchored, and immediately commenced coaling. It was fortunate we did so; for soon it began to blow hard, and ere noon to-day we were obliged, for the safety of the ship, to leave our exposed anchorage, having, however, secured eight or nine tons of tolerable coal. Formerly these coal seams were worked for the supply of the neighbouring settlements; but for several years past it has been found more profitable and convenient to send out coals from Denmark, and thus permit the natives to devote their whole time to the seal fishery."

---

* "Remarks on Physical Geography," by P. C. Sutherland, p. 151. London: Harrison, 1853.

However, it would appear from Sir C. Giesecke's observations, that there is a deposit of fossil leaves at this point. This, then, would be a very promising place for geological investigation.

VIII.—*On the Substitution of Rubidia for Potash in Plants.* By CHARLES A. CAMERON, M.D.

[Read January 21, 1867.]

DURING the present century a great many chemists have occupied themselves in investigating the so-called mineral constituents of plants. Amongst those who have contributed chiefly to our knowledge of this subject I may specialize the names of Daubeny, Way, Ogston, Johnston, Anderson, Voelcker, Norton, Liebig, Weigman, Rammelsberg, Polstorff, Magnus, the Prince of Salm-Horstmar, Staffel, Erdmann, Sprengel, Hruschauer, Bischof, Meigsner, Wittstein, Knop, Grafen, Ratthausen, Boussingault, Ville, and Chatin. The results of the inquiries of these and of other chemists have shed a flood of light upon the nature of the incombustible portion of vegetable substances. We learn from them that certain elements invariably exist in vegetables, and in proportions which, as a rule, vary according to the species of the plant. This knowledge is of the greatest practical importance, apart from the scientific interest attachable to it; because, for example, it enables the agriculturist (and those who assist him) to supply to the plants which he cultivates those mineral substances necessary to their development, and of which the soil may lack an adequate supply.

Although the information which we possess relative to the nature of the mineral substances that actually occur in plants is very extensive and accurate, yet it appears to me that much remains to be learned with respect to the essentialness and the specific functions of certain of those bodies. Elements are occasionally, nay, frequently, found in vegetable organisms, which are obviously the result of accident, and not of design. Copper, lead, and fluorine have been often detected—and in sensible quantities too—in vegetable structures; and cadmium, zinc, nickel, and titanic acid have been found in the altered remains of (fossil) plants: but there is no good proof that any of these substances are essential constituents of plants. Soda and common salt are found in the majority of cultivated plants; constituting in some species—more especially those belonging to the families *Cruciferæ*, *Liliaceæ*, and *Algæ*—from 20 to 36 per cent. of their incombustible portion. These substances are, however, not invariably present in plants; and I have succeeded in developing the most (apparently) soda-loving plants in soils perfectly destitute of that alkali. If, then, soda be as useless to plants as it is unessential to their perfect development, the practice of applying this alkali, or its compounds, for the purpose of fertilizing the soil, is based upon an erroneous belief in its direct manurial properties.

Some years ago I made a series of experiments,* the results of which appeared to show that plants could not be perfectly matured unless potash were supplied to them. All the attempts made to substitute soda for potash failed completely. Although there are some strong points of analogy between potash and soda, they do not appear to me to be so nearly related as some chemists believe them to be; indeed, in many respects soda approaches more closely to magnesia than to potash. There is nothing, therefore, surprising in the fact that the alkali soda is not capable of performing in the vegetable mechanism the functions that are ordinarily discharged by the alkali potash. There are, however, two alkalis that, in all their properties, approximate so closely to potash, that they were long confounded with the latter. Cæsia and rubidia—which, but for spectral analysis, might have existed for ever unknown to man—form, with acids, compounds that are all but identical with the corresponding salts of potash. It occurred to me, therefore, that these newly-discovered alkalis might be substituted for potash in the structure of plants; and having, to some extent, realized my idea, I have now the pleasure of bringing the subject under the notice of the Royal Dublin Society.

The extreme scarcity of cæsia, and its consequent high price, precluded experiments with that alkali; and the great cost of rubidia limited its employment to the smallest practical amount. I regret that the experiments which I shall now describe were not carried out upon a larger and more varied scale; nevertheless, I believe that, such as they are, the conclusions derivable from them would not have been different had I experimented with pounds-weight of cæsia instead of with grains.

In a small vessel formed of block tin I placed an artificial soil, formed of alumina and charcoal. The alumina was prepared from cryolite, and its freedom from the slightest trace of potash ensured. The charcoal was the product of the imperfect combustion of white sugar, ground to the finest powder, well washed with dilute hydrochloric acid and water, and finally dried in a coarsely pulverulent condition. The soil was manured, so to speak, with the following compound:—

	Parts.
Recently precipitated silicic acid,	50
Phosphate of iron,	10
Tribasic phosphate of calcium,	20
Sulphate of calcium,	30
Carbonate of calcium,	10
Sulphate of magnesium,	10
Chloride of magnesium,	10
Phosphate of ammonium,	10
Nitrate of ammonium,	5
Chloride of ammonium,	20
	175

---

* See "Chemical News" for May and June, 1862.

In this soil, so manured, some seeds of curly-leaved parsley (*Petroselinum sativum*) were sown on the 12th of July, 1866. Within thirteen days the greater number of the seeds had germinated and produced plants. These were "thinned" until but two remained, only one of which was finally allowed to mature its seeds; and the other was burned, and its ashes restored to the vessel in which the plant had been developed. During the growth of the plants they were supplied with distilled water, saturated with carbonic acid. The manure employed constituted 2¼ per cent. of the weight of the soil: a much larger proportion would, no doubt, have acted injuriously on the plants. The vessel was placed in a good southern aspect, and was protected by means of a glass shade.

It will be observed, that neither in the soil nor in the manure contained in the vessel was there potash; but the plants were watered daily with a solution of chloride of rubidium. As I had but four grammes, or somewhat less less than sixty-two grains, weight of the chloride of rubidium, I was obliged to re-use, in part, the water which flowed from the vessel in which the experiments were being conducted. This fluid I found contained a considerable amount of the rubidium. I therefore evaporated the greater portion of it in a platinum vessel, and then mixed the concentrated solution with the fresh one. By these means I succeeded in economizing the costly rubidium, and at the same time kept up a continuous supply of it to the parsley. In the month of October the remaining plant produced seeds, which, however, were by no means fine—in fact, very much the contrary; neither could the plant itself be regarded as a fair specimen of its species. Nevertheless the fact remains, that a cultivated plant, in which potash in large proportion usually occurs, was developed in a soil from which potash was utterly excluded. In all former experiments in which I had essayed to grow plants without the use of potash, negative results invariably followed. The question then arises, did the rubidium supplied to the parsley take the place usually occupied by potassium? We must grant that it did, or else that potassium is unessential to plants grown under ordinary conditions. My opinion that in the case which I have described rubidium replaced potassium is strengthened by the results of another experiment, carried on simultaneously. Parsley seeds were sown in a soil and supplied with a manure similar to those employed in the first-mentioned experiment; the majority of the seeds germinated, and produced plants, which were "thinned," but those allowed to remain withered within six weeks after the time of their being sown. These plants had not been supplied with rubidium.

Great care was taken in preparing the artificial soil and manure in which the plants were grown, special attention being directed to the complete exclusion of potash. The parsley plant which attained maturity—i. e. produced seed—was dried, and its organic portion destroyed by Cailatt's method, which for the purpose in view I considered more suitable than Strecker's modification of Erdmann's plan, which I usually adopt. The ashes were examined for potash, but none was found. However, on scrutinizing the residue by means of the spectroscope, I detected the presence of potash, the amount of which in the plant must have been infinitesimal, and was probably derived from the seed from which it was developed.

Cæsium and rubidium have been discovered in plants by more than one chemist. Grandeau found the latter metal in comparatively large quantities in the salts obtained from the beet roots used in a sugar manufactory; and he also found it in tobacco, tea, coffee, and the lees of wine. This chemist inclines to the opinion that rubidia is a necessary constituent of certain cultivated plants—the beet, for example; and considers it probable that this alkali may yet, when found in sufficient quantities, be employed as a manure. That rubidia is essential to plants, when they are abundantly supplied with potash, I am not disposed to believe; but it is almost certain, to my mind at least, that rubidia (and in all probability cæsia) are capable of replacing potash in plants.

Some time ago I examined, by means of the spectroscope, the ashes of thirty-four specimens of plants and vegetable products. In this investigation—in which I had the advantage of Dr. Emerson Reynolds' assistance—the object was to determine the presence or absence of the rarer alkalis.

The plants examined were the following:—The wheat, oat, barley, potato, pea, bean, cabbage, cauliflower, turnip, mangel, clover, mustard, geranium, plum, cherry, gooseberry, coffee, and the ash tree. The organic portions of the specimens were destroyed, in nearly every instance, by prolonged boiling in perfectly pure and concentrated nitric acid. In the case of the coffee (berries), and of one or two of the other specimens, the carbonaceous matter which resisted the action of the acid was reduced to powder, as thoroughly exhausted as possible by distilled water, and the solution evaporated to dryness. The carbonaceous matter was then burned, and its ashes mixed with the matter which had been dissolved in the acid and aqueous menstrua. The specimens were very carefully separated from adhering earth, dust, and other foreign matters, the absence of which was carefully ascertained by examining the specimens through a lens. In conducting the operations of boiling and burning the specimens, and of dissolving their ashes, platinum vessels were alone employed. A large quantity of the distilled water used in dissolving the ashes was evaporated; and the residuum,* on being examined by photo-chemical means, was found quite free from lithium, rubidium, and cæsium. By adopting these precautions the danger of error was diminished to as great an extent as is possible in investigations of this kind. The ashes of the specimens were examined by the spectroscope for lithium, and the newly discovered metals, and the results as stated below were obtained:—

---

* A mere trace of chloride of sodium, which was probably derived from the air during the evaporation of the water.

Name of Plant.	Lithium.	Rubidium.	Cæsium.
Wheat, grain,	*Present,*	Absent,	Absent.
„ „	Absent,	ditto,	ditto.
„ straw,	*Present,*	ditto,	ditto.
„ „	Absent,	ditto,	ditto.
Wheat flour (American),	ditto,	ditto,	ditto.
„ „ (Irish and foreign, mixed),	*Present,*	*Present,*	ditto.
Oat, grain,	*ditto,*	Absent,	ditto.
„ straw,	*ditto,*	ditto,	ditto.
Barley, grain,	Absent,	ditto,	ditto.
„ straw,	*Present,*	ditto,	ditto.
„ „	ditto,	ditto,	ditto.
Potato tops,	*ditto,*	ditto,	ditto.
„ tubers,	*ditto,*	ditto,	ditto.
Pea seeds,	*ditto,*	*Present,*	ditto.
„ „	*ditto,*	Absent,	ditto.
„ stem and leaves,	*ditto,*	ditto,	ditto.
Bean pods,	Absent,	ditto,	ditto.
Cabbage seeds,	ditto,	ditto,	ditto.
„ leaves,	*Present,*	ditto,	ditto.
Cauliflower leaves,	*ditto,*	ditto,	*Present.*
Mangel leaves,	*ditto,*	ditto,	Absent.
Turnip seeds,	*ditto,*	ditto,	ditto.
„ leaves,	Absent,	ditto,	ditto.
Clover seeds,	*Present,*	*Present,*	ditto.
Mustard seeds,	Absent,	Absent,	ditto.
Geranium leaves,	ditto,	ditto,	ditto.
Plum tree leaves,	*Present,*	ditto,	ditto.
Cherry tree leaves,[*]	*ditto,*	ditto,	ditto.
„ unripe fruit,[*]	*ditto,*	ditto,	ditto.
„ ripe fruit,	*ditto,*	ditto,	*Present.*
Gooseberry leaves,[*]	*ditto,*	ditto,	*ditto.*
„ unripe fruit,[*]	*ditto,*	ditto,	*ditto.*
Ash tree leaves,	*Present,*	ditto,	Absent.
Coffee berries,	Absent,	ditto,	ditto.

IX.—*Notes on certain Absorption Spectra.* By J. EMERSON REYNOLDS, Member of the Royal College of Physicians, Edinburgh; Member of Council, Royal Geological Society of Ireland, &c., &c.

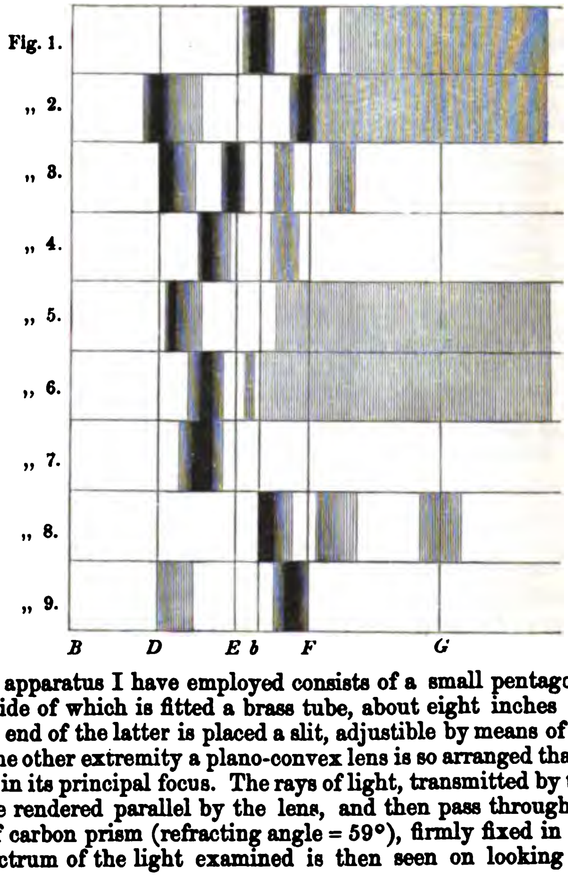
[Read December 17, 1866.]

THE following Notes are the result of some observations made during the past two years, on the manner in which certain coloured liquids act on transmitted light. This subject has already received much attention from Sir D. Brewster, Sir W. Herschell, Dr. Gladstone, and others; but it remained for Professor Stokes, of Cambridge, to give it an unusual degree of interest, by the use of the spectrum analytical method in his valuable researches on the colouring matter of blood. Still more recently Mr. Sorby has applied the spectroscope to the microscope, and thereby materially facilitated the accurate investigation of minute blood stains or other coloured spots.

---

[*] The specimens marked with an asterisk belonged to the same plant.

In the present paper are noted cases in which I have applied the method of spectrum analysis, as a sort of crucial test of the tenability of certain received opinions. I have also used it in examining the murexides and some of the coloured woods; the latter more particularly, with a view to determine certain points relative to their colorific principles, and to their detection when used as adulterants in spirituous solutions.



The apparatus I have employed consists of a small pentagonal box, in one side of which is fitted a brass tube, about eight inches long; at the free end of the latter is placed a slit, adjustible by means of a screw, and at the other extremity a plano-convex lens is so arranged that the slit shall be in its principal focus. The rays of light, transmitted by the aperture, are rendered parallel by the lens, and then pass through a bisulphide of carbon prism (refracting angle = 59°), firmly fixed in the box. The spectrum of the light examined is then seen on looking through the second face of the prism. If the apparatus be pointed at a bright cloud, and the slit adjusted, the chief solar lines of Fraunhofer can be easily seen with the naked eye. When the light is made to pass through a coloured liquid, contained in a test tube, and the latter placed before the slit, we observe the characteristic absorption spectrum of the substance examined. The advantages which this method affords are:—1. Facility in use; 2. The extent of clear spectrum observable; and, 3. The exclusion of all unnecessary light.

Professor Stokes has already fully drawn attention to the distinction to be made between the production of characteristic bands in the spectrum and mere absorption of certain colours. In some cases this is a question of dilution; in others, where no bands are developed under any circumstances, the complementary colours are then simply wanting. Thus, permanganate of potassium, when in dilute solution, gives five beautiful absorption bands in the green; but, if the liquid be concentrated, the centre of the spectrum is cut out, but no bands are observed. On the other hand, the purple colouring matter of most flowers, when in strong solution, produces almost the same degree of general absorption as the permanganate; but if diluted, no bands are apparent, the centre of the spectrum being then merely weakened.

It is curious to remark, in examining the nature of the light transmitted by coloured solutions, the inverse relation sometimes observed to exist between the absorptive effect which a given liquid exerts on the spectrum and the intensity of its colour. We are all familiar with cases of very dilute and slightly coloured solutions, such as those of permanganate of potassium, or nitrate of didymium, which give rise to characteristic and strongly marked *bands;* but cases the reverse of these are not often met with. In the colouring matter of the common blackberry, however, we find a body which, under different conditions, will exhibit either phenomenon; but it must be premised that no distinct bands are produced. If an aqueous solution of the colouring matter be examined with the spectrum apparatus, the liquid, though of a pale purplish-red tint, will be found to absorb very strongly the central portion of the spectrum, commencing near *D*, and shading off about *F*: in rather dilute solutions a trace of a band may be distinguished on the confines of the least refrangible end of the dark space. With the alcoholic solution, however, the case is different; its colour is a magnificent purple, and much more intense than the aqueous decoction; but its effect on the spectrum is very much less marked, though the light actually absorbed is of nearly exactly the same degree of refrangibility as in the first instance.

COLOURED DERIVATIVE OF OPIANIC ACID.

By dehydrating opianic acid, Professor Anderson* produced a colouring matter indistinguishable chemically from madder alizarin. On removing four atoms of water from the acid, we get the formula of alizarin according to the best analyses. Thus—

---

* "Philosophical Transactions, Edinburgh:" xxi., 1204.

$$\underbrace{C_{20}H_{10}O_{10}}_{\textit{Opianic Acid.}} - 4HO = \underbrace{C_{20}H_{6}O_{6}}_{\textit{Alizarin.}}.$$

This was a case, therefore, peculiarly suitable for examination by the optical method.

Opianic acid was prepared by Mattheissen and Foster's process, i. e. by the action of manganic oxide on narcotine. This base, as is well known, gives rise, when oxidized, to cotarnine and opianic acid. Thus:—

$$\underbrace{C_{44}H_{23}NO_{14}}_{\textit{Narcotine.}} + O_{2} = \underbrace{C_{24}H_{13}NO_{6}}_{\textit{Cotarnine.}} + \underbrace{C_{20}H_{10}O_{10}}_{\textit{Opianic Acid.}}.$$

The pure and dry acid was dissolved without heat in some concentrated sulphuric acid, and the solution allowed to stand. Gradually the liquid became coloured, and simultaneously bands appeared crossing the spectrum of the transmitted light. The maximum of clearness and intensity was reached after four hours' standing at the ordinary temperature, and continued for several days.

The spectrum observed is shown at fig. 2; it is marked by a very dark band on *D*, sharp at its least refrangible side, but shading off into the green. Another band on *F* can be seen, but it is not well marked, since the rest of the spectrum is almost wholly cut off beyond this point. In addition to the bands and shading, considerable fluorescence was observed in the red portion of the spectrum. This colouring matter likewise gives the madder tints with mordants; but these compounds do not present any characters worthy of special notice.

When the spectrum of Anderson's alizarin is compared with that of the true madder alizarin, under like conditions (see fig. 1), it will be seen how thoroughly distinct they are in optical properties, though so nearly identical in their chemical relations.

RUFIGALLIC ACID.

The striking parallelism in many physical and chemical properties known to exist between madder alizarin and rufigallic or parellagic acid rendered the comparison of the absorption spectra of the two bodies, under similar conditions, a matter of considerable interest.

Rufigallic acid was prepared by digesting a solution of gallic acid in five times its weight of concentrated sulphuric acid at a gentle heat for a sufficient time. The purple-red liquid was then slowly poured into a considerable quantity of cold water. A brown flocculent deposit was thus produced; this was collected, washed with boiling water, and dried. Re-solution in sulphuric acid and precipitation by water rendered this pure. It possesses the following properties:—It is a tasteless, inodorous, slightly crystalline, brownish-red powder, easily soluble in concentrated sulphuric acid, with the production of a fine purple-red solution, which is precipitated by water. With alkaline carbonates and alum dull purple liquids were obtained. By careful sublimation the powder may be made to yield beautiful orange-yellow crystals, very strongly resembling alizarin of madder prepared by a similar process. As in the latter case, a large proportion of carbonaceous residue likewise remains behind.

When the light transmitted by a sufficiently dilute solution of rufigallic acid in oil of vitriol is examined with a prism, the very characteristic spectrum represented at fig. 3 is observed. The two least refrangible bands are those most strongly marked when the sun is the source of light; while the remaining two, of higher refrangibility, are most apparent with artificial light. It is curious to remark here, that if a very weak sulphuric solution of the rufigallic acid be heated sufficiently, the absorption bands disappear, but become again visible as the liquid cools.

The solution of the acid in carbonate of sodium is reddish-brown, and simply cuts off the most refrangible portion of the spectrum, commencing at *E*; with ammonia a dirty purple-red liquid, which weakens the spectrum, more refrangible than *F*. Alum gives with rufigallic acid a solution of a fine purple colour, which absorbs much light between *D* and *F*, leaving both ends of the spectrum clear. These reactions are remarkably different from those afforded by madder alizarin.

A similar series of experiments were made with the crystalline sublimate obtained from the amorphous rufigallic acid, but the results were identical with those just described; we may therefore state that rufigallic acid sublimes unchanged.

MUREXIDES.

The uric acid and caffeine murexides are so closely allied in chemical constitution, as well as in many of their physical properties, that it appeared to be a matter of interest to compare the action of the magnificently coloured aqueous solutions of each body on transmitted light.

Uric acid murexide was prepared with care by the action of ammonia or a mixture of alloxan and alloxantin and the caffeine derivative by treating amalic acid with ammonia. The prismatic analysis of the light transmitted by the aqueous solution of each did not show any marked difference in their optical properties. In both cases the spectrum was found to be much weakened in the green, but no bands were observed. On the addition of a little hydrate of potassium, the solution of uric acid murexide changed to a violet tint, but its action on the spectrum was not very perceptibly altered. A mineral acid discharged the colour from the original liquid. The solution of the caffeine compound, on treatment with hydrate of potassium, is simply weakened in colour, but it did not absorb light differently. The presence of a free acid does not diminish the intensity or alter the tint very perceptibly.

It was found, in prosecuting these experiments, that when either murexide was prepared by a process different from each of those above-mentioned, that product exerted the same action on the spectrum, but the relations to reagents were materially altered. We therefore learn that the two murexides remarkably resemble each other in optical as well as in general characters; so that, when prepared by similar methods, they do not differ from each other in any important point more than will two samples of the same murexide, when both have been produced by different processes.

I may now mention a curious result obtained when applying the murexide test in a peculiar way, to a solution known to contain pure caffeine. The liquid was acidulated with hydrochloric acid, warmed, and then a crystal of chlorate of potassium dropped in; after digesting for a sufficient time, the whole was allowed to cool, and some strong solution of ammonia carefully poured into the test tube, so that the column of specifically lighter liquid might float on the test solution. This was then left at rest for twenty-four hours, at the end of which time the two liquids were found to have partially mingled, and produced a purple-red colour, which on prismatic examination was observed to cut off two sharp bands in the spectrum, as represented in fig. 4. May we not infer from the results of these experiments that uric acid and caffeine are each capable of yielding several different coloured products?

COLOURED WOODS.

The following comparison of the action of infusions of the different dyewoods in various menstrua was made with a view to furnish reliable data on which to base a method for their detection when employed as adulterants, and also to multiply the means at our disposal for determining the nature of the tinctorial agent used for communicating colour to any given fabric.

LOGWOOD.

The light transmitted by the *aqueous* decoction of the wood of *Hæmatoxylum Campechianum*, when analyzed by the prism, gives the peculiar spectrum represented at fig. 5. This shows a strongly marked absorption band, but little more refrangible than the solar line *D*, the side next to the fixed line being sharply defined, but the second edge shades off gradually to near *E*. A very marked diminution of light is observed in the higher portions of the spectrum, commencing about *F*; the intervening green space is also somewhat obscured. With carbonate of ammonium the solution is of purple-red colour, but the band beyond *D* remains unchanged; a new band, however, appears, rather faintly marked, midway between *b* and *F*: the remaining portions of the spectrum are much less weakened than in the last case. When the solution of the colouring matter is warmed with alum, the band near *D* is alone apparent, the rest of the spectrum being nearly free from shade, with the exception of a slight absorption, extending from the least refrangible edge of the band to midway between *C* and *D*; this is the point from which all light is observed to be cut off in the very strong solution. These are the most striking reactions of the aqueous decoction. The alcoholic tincture of logwood is pale yellow, and simply absorbs the blue rays from about *b*, leaving the remainder of the spectrum unchanged. If to the alcoholic liquid a drop of caustic ammonia be added, a magnificent purple-red colour is produced; this solution gives the single absorption bands just beyond *D* very strongly marked, and leaves both ends of the spectrum perfectly bright and clear. In weak spirituous solutions of the colouring matter other chemical agents react in nearly the same way as in the aqueous decoction.

Pure colourless *hæmatoxylin* ($C_{16}H_{14}O_6$), when allowed to oxidize by contact with the air, affords a solution which reacts in precisely the same way as the aqueous infusion of the dyewood.

BRAZIL WOOD.

The aqueous infusion of the wood of the Lima variety of *Cæsalpina crispa*[*] is of a pale brownish-yellow colour, and acts in a remarkable manner on the light which it transmits. Fig. 6 represents the absorption which it produces in the spectrum. The first, or least refrangible, band is strongly marked; but the second is lighter, and rendered less evident by the considerable weakening of the spectrum beyond it. The addition of a dilute acid but little alters the colour of the solution; but, on examining with the prism, it is now seen to produce but one ill-defined band, intermediate in situation between *D* and *E*. On the addition of a small quantity of caustic ammonia to the infusion, the liquid changes to a fine ruby-red colour; it then absorbs the single band on the confines of the green, as represented in fig. 7, while both ends of the spectrum are perfectly bright and clear. When alum is warmed with the aqueous infusion, the characteristic bands before apparent are replaced by a general absorption of the green rays. The alcoholic tincture of Brazil wood affords precisely the same reactions.

Chevreul was, I believe, the first to separate a *red* crystalline substance from Brazil wood; to this body he gave the name *Brazilin*, as he supposed it to exist ready formed in the tree. Preisser, however, some years later, showed that *colourless* crystals can be obtained from the alcoholic extract, by agitating it with hydrate of lead, and subsequently decomposing the resulting compound with hydrosulphuric acid. The colourless substance so prepared he named *Brazilin* ($C_{18}H_{14}O_6$), and Chevreul's red compound *Brazilein* ($C_{18}H_{14}O_7$). Since it was found that the former was capable of passing by oxidation into a body resembling the latter, Preisser inferred that his colourless Brazilin alone exists as such in the tree, but that on coming in contact with the air it is converted into the red substance. This conjecture may be accepted as fully proved, since I find that the solution of the coloured product of the slow oxidation of carefully prepared colourless Brazilin is identical in essential optical properties with ordinary infusion of the wood.

---

[*] Pernambuco wood gives similar reactions.

CAMWOOD, OR BARWOOD.

The absorption spectrum afforded by the alcoholic infusion of camwood is very remarkable, on account of the considerable refrangibility of the bands which characterize it. Fig. 8 represents the appearance which we observe on examining the light transmitted by such a solution with the prism. It will be remarked that, in addition to the bands situated in the green and blue spaces, a slight shading on *G* is perceptible. If to the alcoholic liquid we add a drop of strong ammonia, the solution becomes of a dull purple-red colour, but gives the peculiar spectrum shown at fig. 9. The first and least absorption occurs a little beyond *D*; the second band is strongly marked, but its borders are ill defined. Potash acts in a similar manner. When boiled with the addition of a single drop of strong alum solution, the two bands of the simple alcoholic tincture are destroyed, and replaced by a shading of the spectrum between *E* and *F*. If to the original liquid a few drops of dilute nitric acid be added, a similar result is obtained; but in this case the absorption takes place between *D* and *E*.

X.—*Notes on a Tour in Norway in the Summer of* 1866. By FREDERICK J. FOOT, M. A., F. R. G. S. I.

[Read February 18, 1867.]

I STARTED from Hull on Friday night, July 6th, and reached Christiansand on the 8th.

The coast here bears a striking resemblance to parts of the west coast of Scotland; the same flowing outlines of the bare rocky shore, and the numerous islets of smooth and rounded rock, thickly studding the sea, forcibly call up recollections of Skye, Mull, Iona, &c. This rugged bareness is, however, considerably softened down by the background of dark pine forest, with which so much of the interior of the country is covered.

Finding that the vessel would not leave Christiansand till the next day, I went ashore, and proceeded to explore the rocks which form a sort of amphitheatre around the town. They consist of gneiss; they are smoothed and rounded to a wonderful extent, and marked with parallel grooves and striations engraved by the ice, which, beyond all doubt, formerly covered the country.

I observed growing abundantly on these rocks *Silene rupestris*, *Ajuga pyramidalis*, *Asplenium septentrionale*, *Polypodium phegopteris*, *Sedum telephuim*, *Juniperus nana*, *Cornus Suecica*, *Dianthus deltoides*, and a beautiful trefoil unknown to me. Several wheat-ears (*Saxicola œnanthe*) were flying about near me.

The water at Christiansand is exquisitely clear; and countless medusæ, some of which were of great size, surrounded the ship as she lay at anchor: they are so numerous, that they render bathing disagreeable.

We left Christiansand on Monday, the 9th, and early on the following morning we arrived at Christiania. I visited the Botanic Garden (*"Botanik Haven,"* or *Teyen*), which is about an English mile from the town, for the purpose of getting an idea of the plants which I might meet on my tour, and of which there is a fine collection here. Dr. Moore refers to it in his interesting paper, read before the Society in December, 1863.

Papaver nudicaule, with its bright yellow flowers, from the Dovre Fjeld, and the singular fern, *Botrychium matricarioides*, particularly attracted my attention.

Next day I left Christiania on foot, *en route* to Bergen, by the Ranz Fjord and Fille Fjeld. On the roadside, at a short distance from the town, there is a good section in beds of dark grey indurated calcareous shale, with hard calcareous nodules in the lines of bedding, dipping N. N. W., at 40° to 60°.

The commonest plant along the road hereabouts was *Verbascum nigrum*.

Shortly after passing Sandrigen, which is some eight or nine English miles from Christiania, the road turns to the N. N. W., and there are good sections in the shaly calcareous rocks, showing a general dip to north. The surface of the rock is smoothed, furrowed, and striated—the direction of the striæ being about W. N. W., or the same as that of the valley.

As we proceed up this valley it contracts, and the road gradually becomes steeper. There are many ridges of drift running in the direction of the valley; and the road in a sharp turn cuts through one of them, showing a section of stratified sand and gravel.

As we ascend the pass, the scenery becomes very fine, the road running through a dense forest of fir trees. The rock now met with everywhere is a dark reddish-brown porphyry, which, further on, rises into bold cliffs. This porphyry overlies the calcareous beds above mentioned.

Close along the roadside I observed, growing in the greatest luxuriance, *Woodsia ilvensis*, *Woodsia hyperborea*, *Struthiopteris germanica*, and the stately *Aconitum septentrionale;* and almost everywhere the exquisite little flowers of *Linnea borealis* met the eye; patches of peaty ground were covered with *Betula nana*, and *Rubus chamæmorus;* and with them a tiny *Eriophorum*, or cotton grass, the species of which was unknown to me.

On reaching the top of the pass, the sublime scenery of the Tyri Fjord breaks on the view. This, as well as the Ranz Fjord, is an inland freshwater lake; but it is said to have been within the memory of man open to the sea, communicating therewith by the Drams Fjord, a branch of the Christiania Fjord, and therefore it still retains the name of Fjord.

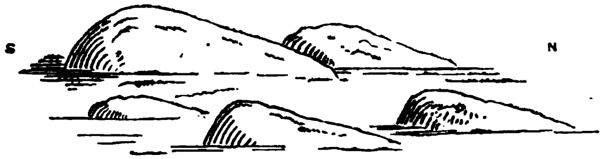
The porphyry now forms high cliffs along the east side of the road, and is frequently traversed by greenstone dykes. At the foot of the cliffs is a great talus of huge fallen blocks. The sides of the cliffs are smoothed, moulded, and grooved, in the direction of the valley, the telescope enabling one to trace those characters up to their summits. The rocks on the west side of the road and which are on a level with it, and afterwards form the slope down to the Fjord below, are similarly "*dressed.*"

These mouldings and groovings are the signature of a gigantic glacier, which once ground its steady course down the valley towards the sea. The ice has long since passed away, but these marks remain silent witnesses of the fact. The cliffs, being "dressed" to the top, show that the valley was once brimful of ice, probably a part of one great ice cover that invested the whole country.

Hereabouts I met with *Trientalis Europæa*, *Pyrola minor*, *Ajuga pyramidalis*, *Erigeron alpina*, the two *Woodsias*, *Linnæa borealis*, &c., &c.

The road winds rapidly down to the Tyri Fjord; the scenery increasing in grandeur as we proceed. Immediately about Humledal station, which is, say, twenty English miles from Christiania, there are some fine "*roches moutonnées*," exhibiting instances of *boss crag and tail*,* or rocks smoothed and rounded with long slopes (*tail*) in one direction, and blunt faces (*crag*) in the other. The *tail* almost invariably stretches to the north, or inland, while the *crag* looks south, or seaward; and their general direction is identical with that of the great valley in which the Ranz Tyri and Drams Fjord lie, and which was once brimful of ice, grinding its way over these rocks to the sea at the Christiania Fjord—(see Fig. 1).

Fig. 1.



About an English mile beyond Humledal, at a sharp turn of the road, the porphyry assumes a spheroidal structure, exhibiting large globular masses, often eight feet in diameter, parted by a curious ashy substance, looking conglomeritic.

---

* By this expression Mr. Foot intends to make an important distinction, which has been sometimes too much overlooked. "*Boss* crag and tail" usually, though (as Mr. Foot observes below) not invariably, indicates the direction from which the ice has moved, by the *tail* or long slope pointing up stream; but *hill* "crag and tail" seems to be generally, though perhaps not always, unconnected with glacial denudation.

A little farther on we find a good section in the dark shaly calcareous rocks, which here are associated with thin grey limestones and schistose bands containing—see*

These beds undulate to N.W. and S.E., at high angles, and presently become very much contorted. The limestones and shales occupy the low ground along the road, while the porphyry forms the high cliffs on the east.

These cliffs are clad with pines to their summit; the dark brown rock protruding in bold bluffs and tors. Looking from thence across the Tyri Fjord, I had the first view of snow, lying in large patches on the Hallingdal mountains.

Some few hundred paces further on, near a new house on the roadside, just above a little landing place on the Fjord, red sandstones and shales dip N.E. at 50° or 60°. There is a continuous section in these beds along the roadside for fully a quarter of an English mile, the dip being N. or N. N. W., at from 40° to 60°; so that there is apparently a considerable thickness; but it may be that the beds are contorted, and the summits of the anticlinal fold denuded, giving the appearance of a continuous section to a repetition of the same beds. These sandstones are lithologically like some of our so-called Old Red Sandstone in Ireland.

As we proceed, the porphyry capping the limestones and red sandstones still form towering cliffs on the right hand; and presently the Red Sandstones and shales are seen in a horizontal position. The rocks are all beautifully rounded and scored in the direction of the valley; and, looking upwards, I could see plainly that the lofty cliffs were similarly dressed up to their summits. The *roches moutonnées* still have their blunt faces to the south.

In one place there is an intrusive mass of syenitic greenstone at the east side of the road, forming a wall sixty feet in height, the vertical face of which is beautifully scored and striated; and not far from this the red sandstones appear again and dip east at 10°.

The scenery here is truly magnificent—the Tyri Fjord, backed by the snowy Hallingdal, lying on the west side, and the porphyry tors and bluffs of Krogleven rising majestically on the east.

---

* Mr. Foot was apparently going to speak of the fossils contained in these rocks. He had, however, written to Norway for information concerning them, and shortly after his death there arrived by post, addressed to him, a paper, entitled

"Veiviser Ved Geologiske
Excursioner I Christiania Omegn.
Med et Farvetrykt Kart og Flere Traesnit
Af
Lector Theodor Kjerulf."

Reference to this coloured map shows two bands of rock, a little north of Humledal, which are called, the one "Conglomerat sandstein og rod Lerskifer;" the other, "Etage 8 med yngste Ortoeer Kalk og Græptolitskifer." It was evidently the well-known "Orthoceras Limestone" and "Graptolite Slate" that Mr. Foot saw in this locality.—See Murchison's "Siluria," p. 365, *et seq.* (J. Beete Jukes).

At Sundvolden station a narrow branch of the Fjord is crossed by a bridge; at the west side of which there is a section, showing the Red Sandstones dipping to the east at from 20° to 50°, and a little further on we find the limestones and shales.

Continuing along the road, at a distance of about half a mile (English) from Sundvolden, a fine junction between the limestone and porphyry is exposed, the latter resting on the denuded edges of the former.

At Vik station, ten miles (English) from Humledal, I was served with an excellent fish, freshly caught in the Tyri Fjord, and called in Norsk *Sik*. It looked to me very like our Pollan (*Corregonus pollun.*)

I may here mention that since leaving Christiania, besides our commoner birds, I observed the common red start (*Motacilla Phœnicina*, Linn.), the pied flycatcher (*Muscicapa atracapilla*), the hooded crow (*Corvus cornix*, Linn.), to be very abundant.

I saw neither choughs nor rooks, but the most abundant bird was the fieldfare (*Turdus pilaris*), for Norway is its chief summer residence. I had observed several large toads about Humledal.

At Vik station the flaggy limestones are well exposed, dipping S. or S. E., at 10°.

Beyond Nordehaus some black shales, with ironstone nodules, set in with a northerly dip; and some three English miles further north I found black shales, interstratified with shaly limestone, and beds exactly like those near Christiania, dipping about N. W. at 50°. There is a tolerably continuous section in these beds, showing dips in opposite directions, from here to the Ranz Fjord.

I stopped that night at a new station, kept by a man named Josh. Skogstadt. The view from this place is very fine; on the opposite side of the valley a dense forest of pine trees stretches away to the foot of the distant Hallingdal, with its snowy patches. It reminded me of scenes in the neighbourhood of Braemar, in Scotland.

Next day I proceeded to Hadelands, at the south end of the beautiful Ranz Fjord. This lake is somewhat like Loch Lomond, but on a much grander scale, being some fifty English miles in length: near the northern end of the lake, and on the east side of it is an abrupt, and picturesque wooded hill—a boss of granite protruding through the limestones and shales, which may be seen here on the shore of the lake, dipping north at 30° or 40°.

At Odness, on the north end of the lake, we come upon the gneiss, which is here much contorted.

Thence I proceeded, by Skoien and Tomlevold, to the beautifully situated station of Gravdalen, the scenery all the way being very grand. The Scotch fir hereabouts grows to a great height, and on the bare gneiss rock, often without any soil whatever.

Close to Gravdalen, on the opposite side of the valley, is a very fine waterfall, or foss: this would be a delightful place in which to spend a few days exploring the neighbourhood. The gneiss rocks here are finely rounded and scored in the direction E. 20° N., being that of a lateral glen which here joins the main valley.

After leaving Gravdalen, I observed on peat banks along the road side *Rubus chamæmorus* in great quantities, also *Polygonum viviparum*, the little cotton grass, before mentioned, and many beautiful willows unknown to me. On reaching the top of the pass, the snowy Hallingdal again comes in view.

Near Fagness I observed *Pyrola uniflora*, *Linnea borealis*, &c.; and Alpine strawberries, of a very fine flavour, grew in profusion along the roadside.

The scenery is very grand as we approach Ogloe, and there are several fine waterfalls. A good deal of snow rested on the hills.

I left Ogloe early on a bright, hot summer's morning; one could hardly imagine one's self to be beyond sixty-one north latitude. My way lay through glorious scenery. The first part was along the shore of little Mjosen Lake, a beautiful sheet of water, some ten miles long. It is a perfect rock basin, shelving at the eastern end, and of very great depth at the western.* I could see myriads of trout, some of good size, swimming about in its exquisitely clear blue water.

On the gneiss rocks, by the roadside, I observed *Alchemilla alpina*, *Saxifraga cotyledon*, *S. aizoides*, *S. oppositifolia*, with fine purple flowers, *Cornus Suecica*, *Silene rupestris*, the two *Woodsias*, in abundance, *Cerastium alpinum*, *Epilobium alpinum*.

About two English miles beyond Thune station the road runs by enormous masses of tumbled rock, lying about in great numbers; and further on, near the western end of the lake, patches of sand and gravel occur.

Passing Skogstadt station, I commenced the ascent of the Fille Fjeld. It is a long and fatiguing pull; but the road is good, and the glorious scenery makes up for the labour. On the way I observed *Trientalis Europæa* in abundance, and many beautiful willows and saxifrages.

There were numbers of fieldfares flying about; and I saw here the common redstart, 3000 feet above the sea. Near the top of the plateau there was plenty of snow lying in the hollows and ravines most sheltered from the sun.

The Fjeld is a rolling moor, with bosses and hillocks of rock rising up abruptly here and there. I was supplied with reindeer steaks, &c., at Nystuen station. It was early to get reindeer, as the shooting does not commence till August 1st, and this was only the 15th of July. There was a good deal of snow on the ridge of hills rising from the Fjeld, north of the road; and on the top of the ridge, standing out clearly against the sky in the evening light, I could see numerous perched boulders, which must be of enormous size. The peaty ground, on each side of the road, was covered with *Rubus chamæmorus*, *Betula nana*, and many other plants.

---

* This quite agrees with Professor Ramsey's theory of rock basins.

Here for the first time I saw some lemmings (*Georychus lemmus*, Cuv.); they were running about in numbers. At the sight of an intruder they immediately squeal, and run for shelter behind a stone or tussock, where they can be easily caught. The Norwegians kill them whenever they meet them, as they are said to be very destructive to crops. The dusk of the evening seems to be their favourite hour for leaving their retreats. I believe it is a mistake to suppose (according to popular idea) that they only visit Norway once in four years. I was told, by several persons, that they may be seen every summer.

From the plateau of the Fjeld, the road descends rapidly to Maristuen, the scenery about which is magnificent.

Leaving Maristuen, the rocks along the road are all rounded and scored, as usual, in the direction of the valley; and here again the *roches moutonnées* have their long slopes eastward, or inland, and their blunt faces westward, or towards the sea.

Having crossed the Fjeld (the watershed of the country), we find the directions of the *crag* and *tail* reversed.

From this watershed the ice, when it covered the country, made its way down the valleys on the east side to the sea, at the Christiania Fjord, "dressing" the rocks, as we saw them at Humledal and else where, with their long slopes towards the N. W., and their "bluffs" towards the S. E.; while on the west side of the watershed it took its steady course to the sea, at the Sogne Fjord, grinding the rocks into the forms in which we now find them, with their long slopes towards the east, and their "bluffs" to the west.

I do not mean to assert that this is always the case with every boss of rock; as sometimes the bedding, or other local circumstances, such as unequal hardness in the rock itself, &c., may have prevented it; so that some bosses slope equally both ways, and some are even reversed. But I mean to say that it is generally the case, the exceptions being probably not five per cent.

This is most interesting with respect to the glacial theory. Norway, furrowed by innumerable valleys, descending to the sea from a strongly marked line of watershed, these valleys all having their rocks scored and striated in lines, coinciding with their direction.

Smaller lateral valleys and glens, opening into the main valleys, have their rocks scored in lines parallel to their own course.

Perpetual snow and ice, in the higher parts of the country, are now sending down glaciers, which are at this moment scoring the rocks in the same fashion.

It can hardly be doubted, then, that the lower valleys and glens were once occupied by ice descending to the sea from the high ground; it can also hardly be doubted that the slopes and bluffs of the *roches moutonnées* are due to the action of that ice.

If, then, we come to an open, plain country, like the centre and parts of the West of Ireland, and find there rocks assuming the form of *roches moutonnées*, with surfaces covered with parallel grooves and striations, and having long slopes and bluff faces, whose directions generally correspond with each other, and with the groovings, I think, from what I have seen in the Norwegian valleys, that one is safe in assuming that moving ice was the cause of the scorings, and in conjecturing the direction from whence it came, from the slopes of the *roches moutonnées.*

Good exposures of rock, having all these conditions, are not so common in Ireland as in Norway, though parallel striæ are met with in this country on almost every freshly exposed surface.

There is a tolerably good example, which may be mentioned, in the county Sligo, ten miles or so to the west of Boyle, where a considerable tract of ground is occupied by nearly bare conglomerate rock, the surface of which is everywhere marked with parallel grooves and striæ, and appears in many places as *roches moutonnées,* with long slopes and bluffs, having the same general direction.

Many good instances can be found among the glaciated rocks about Glengariff, and many other places in the south of Ireland.

A few miles beyond Hogg station, the road crosses an abrupt spur of the mountains, round which the river sharply winds. By a long, gradual ascent we reach the summit of the spur of high ground, or top of the pass.

The descent at the other side is tremendously steep— indeed, precipitous in places—but the road is carried down by a series of admirably constructed zigzags. In fact, this spur of rock is a huge *roche moutonnée,* an instance of *crag* and *tail* on a gigantic scale; the long slope being eastward, or inland, while the precipitous face or bluff, down which the zigzag road winds is westward, or towards the sea.

About here I saw the fieldfare (*Turdus pilaris*) in great numbers; the hooded crow (*Corvus cornix*), the magpie (*Corvus pica, Linn.*), and several willow wrens (*Sylvia*).

About an English mile beyond Husum station, the Scotch fir becomes very plentiful, and attains great size; the scenery is sublime, and the rocks wonderfully glaciated; there are slopes of 40° which the *ice must have gone up.* The most conspicuous plant was *Saxifraga cotyledon.*

There could hardly be too much said of the solemn grandeur of this part of the Leirdals valley, with its towering precipices, hills clothed with tall pine trees, and glens echoing with innumerable waterfalls. In one place, the road (overhanging the deep gorge, through which dashes the Leirdals Elven in a roaring torrent, one hundred feet below) has been blasted out of the face of a perpendicular cliff, and there is just room for a carriage to pass. At every bend and turn of the glen the striæ and groovings trend with it.

At an abrupt turn to the N. W., where the Nybloe Elv joins the Leirdals Elv, there are some well defined terraces of stratified sand and gravel, through which the river has cut a section. One of these terraces is traceable as far as Blaaften station—a distance of more than two English miles—the road running along its foot. I had no means of measuring its height above the road—but it seemed to be about two hundred feet. On the flat surface are houses and cultivated land;

in some places it has all the appearance of a huge artificial embankment.

At Blaaften I noticed, growing on flat sandy ground, composed of the same materials (sand, gravel and shingle) as the terraces above, and through which the river is now cutting its course, *Lychnis viscaria*, *Erigeron uniflora*, and an Arabis, which was unknown to me.

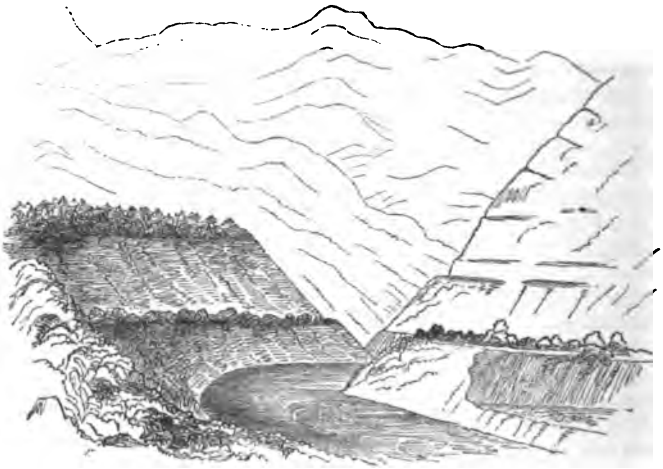
The river, which flows close to the station, abounds in salmon (*Lax*); but the people are too inert to catch them.

I remained one night at Leirdalsören, which is situated at the head of Leidals Fjord, one of the extreme eastern branches of the great Sogne Fjord. The water of the Fjord is so slightly salt that one can drink it; indeed, this is the case with all the far-inland branches of the Fjords. The steep cliffs here plunge sheer into the water, and are quite bare, and completely glaciated.

From thence I started by boat, with two men, for Ronneid, at the head of the Lyster Fjord, a distance of some twenty-five English miles.

At Eirdal, on the west side of the Fjord, are two finely marked terraces. On entering the Lyster Fjord, the water has a milky appearance, becoming whiter and thicker as we ascend the Fjord. This is due to the fine *débris* carried down from the Jöstedal glaciers by the river which flows into the head of the Fjord. Here, then, is a constant deposit going on in the Lyster Fjord: it is not carried out to sea, but gradually sinks in the still water.

Fig. 2.



I landed at Marifioren; but Ronneid, at the very head of the Fjord, and two English miles distant, is more convenient for those who would visit the glaciers. Here is a large moraine, and some finely marked terraces of yellowish-white sand and gravel, cut through by the river, a turbid milky-white torrent, ever bearing down to the Fjord the fine *débris* from the glaciers. These terraces can be traced for five or six miles up the valley. (See fig. 2).

What are these terraces of sand and gravel? How were they deposited? And how were they left in their present form? There is hardly a valley or glen in Norway leading into a Fjord where they are not to be seen.

Mr. C. M. Doughty mentions them in an interesting paper "On the Jöstedal Bræ Glaciers," visited by him in 1864. He ascribes their origin to the river ever changing its course, and working from side to side. He says, "In one place I discovered with much surprise a series of miniature longitudinal terraces, which had been formed in this way," &c.

The river at, and for some distance above Ronneid, is plainly cutting its way both vertically and horizontally through the soft sand; this of course adds to the detritus brought down from the glaciers. This detritus is all deposited in the bottom of the Lyster Fjord. After the lapse of ages the deposit would be of a considerable depth. If, then, there were an elevation of the land, with periods of repose, terraces would be formed by the action of the sea; and afterwards these terraces would be modified, and much worn away by the action of the river. Or, if there were no periods of repose, the sea might have no effect, or but little, in the calm and sheltered Fjord, and the river might be the sole agent, as Mr. Doughty supposes.

I saw no terraces in Norway as perfect as the parallel roads of Glen Roy, in Scotland; and I think the theory of the damming up of water by a glacier, as proposed by M. Agassiz, is the only one to account for that particular instance. But I believe that these Norwegian terraces can be more simply explained by reference to causes similar to those now in operation, and which we can distinctly see going on. The materials of the terraces may not have been brought down by a river at all, but by the glacier itself, which came down to the sea level. Similar terraces are known in other parts of the world.

Mr. J. K. Lord, in a paper in the "Intellectual Observer," for December, 1866, entitled "On a New Charr from British Columbia," mentions meeting terraces of shingle and boulders. He says there is hardly a valley between the Rocky Mountains and the Pacific coast lower than 4000 feet above the sea, in which the shingle terraces are not met with.

M. Desor, in his "Excursions et Sejours dans les Glaciers et les Hautes Regions des Alpes de M. Agassiz, et de ses Compagnons de Voyage," mentions the occurrence of regular longitudinal terraces in the valleys of Reichenbach and Engelberg, in Switzerland; he appears to have considered them moraines. I shall have to recur to these terraces in the course of this paper.

The only accommodation to be had in the neighbourhood of the glaciers is at the house of Herr Rasch, the Priest of Jöstedal, twenty-one English miles up the valley from Ronneid. Herr Rasch is most hospitable and friendly, and can speak German.

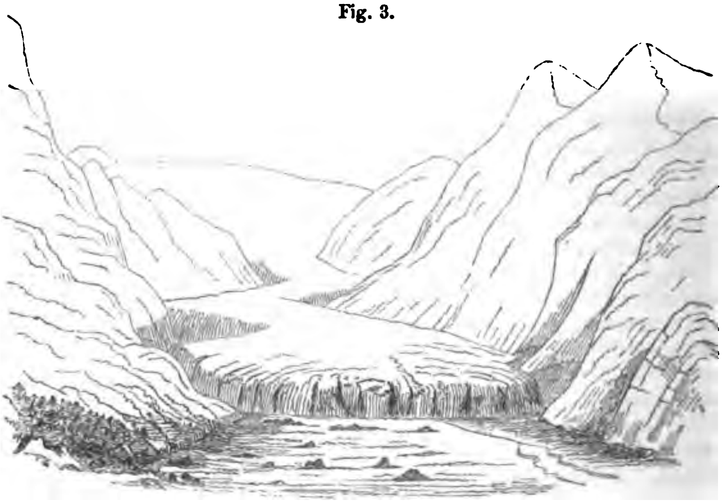
There is no road up Jöstedal, but merely a horse track, which is in places very steep and rough, running over the smooth bare *roches moutonneés*, but sometimes for a mile or so leading along grassy flats beside the milky stream.

The scenery all the way is bold and varied. The spruce and Scotch fir grow to a great height, the bright orange colour of the tall straight stems contrasting finely with the sombre dark green foliage.

I saw the Tithys redstart, and the common redstart, in abundance, and several green woodpeckers (*Picus viridis*, Linn.) Among the plants I observed *Polygonum viviparum*, *Trientalis Europæa*, *Cornus Suecica*, *Listera cordata*, *Linnæa borealis*, *Woodsia ilvensis*, *Ajuga pyramidalis*, *Lycopodium annotinum*, forming large mats on the rocks; *Smilacina acifolia*, in great abundance; *Menziesia cærulea*, *Pyrola minor*, &c., &c.

Beyond Jöstedal Church the wildness and beauty increase at every step. A walk of some four English miles brings us to a bridge, which crosses a rapid milk-white torrent, a tributary of the main river, coming down from the glacier of Bergsœt Brœ (or Breen). I did not visit this glacier. Mr. Doughty in his pamphlet says, "It plunges down into the valley, very steeply in a great sheet, and two smaller streams on either side flow down near it."

Fig. 3.



Having crossed the bridge, I proceeded along the rocky path for about three miles, when suddenly the Nygaard glacier, glistening in the morning sun, burst on my view. (See fig. 3). It lies in a deep gorge, the opening into the Jöstedal valley.

It may here be mentioned, that the glaciers are the tongues or outlets of the extensive crusts of ice, which now perpetually cover large tracts of Fjeld. Jöstedal Breen is one of these tracts, sending out tongues of ice down its gorges on all sides.

Nygaard glacier is said to be nine miles in length, averaging one in breadth. It ends in an abrupt cliff or snout, which I estimated at eighty feet in height. This abrupt face is cleft by vertical fissures, the blue tint of which contrasts beautifully with the brilliant white mass of the glacier.

It is fully an English mile from the path to the termination of the glacier. The intervening space is a flat, or gently inclined stony waste, through which turbid white streams flow from the ice; and there are numerous little mounds and ridges of shingle and boulders brought down by the ice when it extended further than at present. As one approaches the glaciers the azure hue of the fissures, and of the vaults from which they issue becomes more intense; it is an indescribably exquisite shade of blue.

I was fortunate enough to meet a young peasant, who offered to guide me to the surface of the glacier. After a tough scramble among loose masses of rock, earth, and snow, we eventually reached the surface. It was an undulating mass of ice, perfectly free from blocks of stone or rubbish, and suggested the idea of a stormy sea suddenly congealed. At first it appeared hopeless to attempt to walk on it; but with the aid of spikes, strapped on to my boots, and a stout staff with an iron spike, I found I could get on pretty well. But my guide was unprepared, having neither spikes or stick, so I did not attempt to cross the glacier. I ascended to a place where it was comparatively level, or rather where the waves were longer, and was able to examine several fine crevasses. The intensity of their blue colour exceeds even that of the vertical fissures seen at the terminal cliff. The foot of this glacier is about 1060 feet above the sea level.

Growing on the *débris* between the glacier and the pathway leading through the main valley, I observed *Menziesia cærulea* in great quantities, *Pyrola minor*, *Woodsia ilvensis*, *Gymnogramma leptophylla*, &c. Continuing my course some six or seven miles up the wild gorge of Jöstedal, I came in front of Faabergstols Brœ glacier. It appears to have a much steeper incline than Nygaard glacier.

Mr. Doughty, in describing it, says, " At the present day it ends in a low shattered front, pouring out water in several streams; but formerly it reached quite across the river, which then ran in an icy tunnel."

As one stands in the rugged path facing the glacier on the opposite side of the gorge, there is a fine view of the great ice-bound Fjeld of Jöstedal, with the dark rock known as " Lodal's Cloak," rising from it more than 6000 feet above the sea. Time did not admit of my proceeding further up the gorge; so I returned to Jöstedal, and thence next day to Ronneid.

Herr Rasch informed me that bears are plentiful in Jöstedal, but not easy to find till the snow comes on, when they can be tracked.

In winter the thermometer falls 28° below zero of Reaumur's scale (31° below zero, or 63° below freezing point of Fahrenheit's scale); and in summer rises to 37° at the south side of his house, and to 20° on the north (115° F., and 77° F.). This is in between 61° and 62° north latitude.

From Ronneid I took steamer back to Leirdalsören, and thence down the magnificent Nero (narrow) Fjord, to Gudvangen. As we approach the station the Fjord becomes very narrow, with cliffs rising abruptly 5000 feet from the water, rounded and scored up to the very top. Gudvangen is very good quarters, and perhaps the most beautiful spot in Norway. From thence I proceeded southwards. Some four miles from Gudvangen the steep col at the head of the valley is ascended by a series of cleverly constructed zigzags; it is a considerable ascent, and the view down the valley is superb.

Near Twinde, where there are some picturesque rapids in the river, I observed a great accumulation of enormous masses of tumbled rock, the largest I have ever seen; huge fir trees grow on some of them. The green woodpecker (*Picus viridis*, Linn.) was very abundant in the woods about Twinde; and I saw several red-breasted mergansers (*Mergus serrator*, Linn.) disporting themselves in the river.

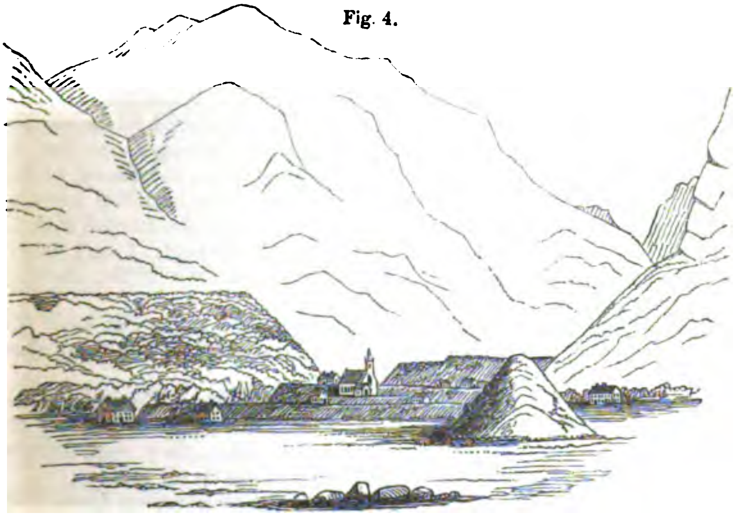
Vossevangen, some twenty-eight English miles from Gudvangen, is beautifully situated on the shore of a lake, with snowy mountains in the background. The rocks here are all rounded and grooved to their summits. Between Vossevangen and Vasenden, the next station, there are some very curious roofed wooden bridges across the river. From Vasenden I took a boat across a small lake to Graven, and thence walked to Ulvik, some seven or eight English miles across a Fjeld, the ascent and descent of which are very steep. Near a little tarn on the top I observed on the gneiss rocks *Polystichum lonchitus*, *Allosorus crispus*, *Woodsia hyperborea*, *Saxifraga cotyledon*, *Circæa alpina*, *Silene rupestris*, *Ajuga pyramidalis*, &c., &c.

Ulvik is a water station on the Hardanger Fjord; near it are some fine terraces. The water here is hardly at all salt. From this I took boat to Vik, some eleven miles distant, at the head of the Eid Fjord. The cliff scenery is magnificent the whole way, the rock exhibiting strongly the traces of glaciation from top to bottom. At Erdal, a short distance from Vik, there are several terraces at the mouth of a small valley, and extending partially up its sides; but at Vik they are particularly fine, extending up the valleys of the Eid Fjord Vand and Smmedalen. (See fig. 4.)

On reaching Vik I started at once for the Voring Foss, one of the highest waterfalls in Europe. About a mile from Vik you cross the Eid Fjord Vand to Sæbo, and thence strike eastwards up a transverse glen, or narrow valley, down which comes the water from the great Voring Foss. At the mouth of the transverse glen, and extending up its sides for some distance, are terraces of sand and gravel.

The Eid Fjord Vand is a fine example of a glacier lake; the bare gneiss rocks, rounded and scored by glaciation, rising almost perpendicularly from the water. I had not an opportunity of sounding it, but it is apparently of great depth. It is dammed by a great moraine, beyond which a series of terraces of sand, gravel, and boulders, stretch to the sea, and through which the rapid stream from the lake has cut, and is still cutting its way. From this, after crossing the moraine at the mouth of the transverse glen, there is a tolerably good horse track for a few miles, till we come to a steep escarpment, rising abruptly some 1000 feet or so above the head of the glen, which is scaled by a zigzag path, cut for the most part out of the rock in rough steps. Climbing this we stand on a rolling moor, carpeted with ***Rubus chamæmorus***, ***Cornus Suecica***, ***Betula nana***, and numerous willows, with bosses of bare gneiss rock cropping out in all directions. On our left hand is the gorge coming down from the great Voring Foss; but so deep is it, and so secluded is the situation of the fall itself, that no sound betrays its locality. The trackway leads to the mountain farm of Höl, where refreshment may be procured, and a guide. Ten minutes' walk or so brings you to the edge of the precipice, where, 300 feet below you, the roaring torrent takes its leap of 900 feet into the abyss of the deep gorge, which its own waters have scooped out.

Fig. 4.



Returning to Vik, I proceeded, next day, up Simmedalen to see the Skyttie Foss, which is seven hundred feet in height.

The stream which flows down the valley is white and turbid, with the *débris* of the glaciers of Jokullen. It has cut a section through terraces of sand, gravel, and boulders, which have a general angle of repose of 28°. These terraces lie at the mouth of the valley, and extend up it for one or two miles, where they abut against a moraine of similar materials, but containing more boulders. Beyond this moraine, as we ascend the valley, we find other terraces, strongly defined on both sides. There are five distinctly marked terraces, apparently quite level on the top, and formed of stratified sand and gravel, and occasional boulders of gneiss.

Near the church is a small esker-like ridge, which is probably the remnant of a terrace. I carefully examined the terraces at Vik, and searched for shells, but found none.

Leaving Vik, I went by steamer to Odda, at the head of the Sör Fjord, a branch of the Hardanger. This is a beautiful trip. On the west side of the Fjord is the ice-capped Fjeld of the Folge Fond; and in one place, high up above some farms, a glacier glistens in the sun.

There are very fine terraces of sand and gravel at Odda: ascending them we come to a lake, with steep rocky shores, dammed in by a moraine of gravel and huge blocks of gneiss. The steep cliffs overhanging the lake are glaciated from top to bottom.

I took boat to the small village of Jordal, at the mouth of a transverse glen, in which lies a glacier, one of the tongues of the Folge Fond ice cap. There is a good footpath all the way; the distance being about four English miles.

The glacier is small, but very beautiful; it has apparently a steep incline. The perpendicular height at the end is about forty feet, or so; and the turbid white stream issues from a vault of exquisite blue colour. There seemed to be a good deal of rubbish on the surface; and on looking into the vertical fissures of the crevasses one can see, jammed between the icy walls, large blocks of stone, and masses of clay, that have dropped from the surface. There is no terminal moraine; but when, eventually, these blocks and rubbish are discharged from the ice, they are worn down and carried off by the torrent. I may remark that, while I was looking into the vertical open ends of the crevasses, several large blocks of ice were detached.

The foot of this glacier is about 1000 feet above the sea. The highest point of the Folge Fond has been estimated at 5460 feet above the sea.

It should be kept in mind that these ice Fjelds of the Folge Fond, Jöstedal, and others, are miniatures of what the whole of Norway and a great part of the British Isles once was, when they were covered with great sheets of ice, coming down to the sea on all sides.

In this glen I observed the kestrel (*Falco tinnunculus*, Linn.), the water ouzel (*Cinclus aquaticus*, Bechst., *Sturnus cinctus*, Linn.), the pied flycatcher (*Muscicapa luctuosa*, Temm.), the marsh titmouse (*Parus palustris*, Linn.), and abundance of fieldfares. The commonest plants were *Lycopodium annotinum*, *Linnæa borealis*, *Menziesia cœrulea*, *Smilacina acifolia.*

Returning to Odda, I again got on board the steamer, and went down the magnificent Hardanger Fjord to Bergen, which is beautifully situated at the head of a small bay enclosed by rocky hills and forests.

From Bergen I proceeded northwards by the land route, which traverses many Fjords and lakes. The scenery of these numerous Fjords is very fine—the greatly glaciated gneiss rocks rising sheer from the water to immense heights. At the water's edge they are often covered with *Anomias;* and in shallow places I observed numbers of purple and green *Echini* with white spines.

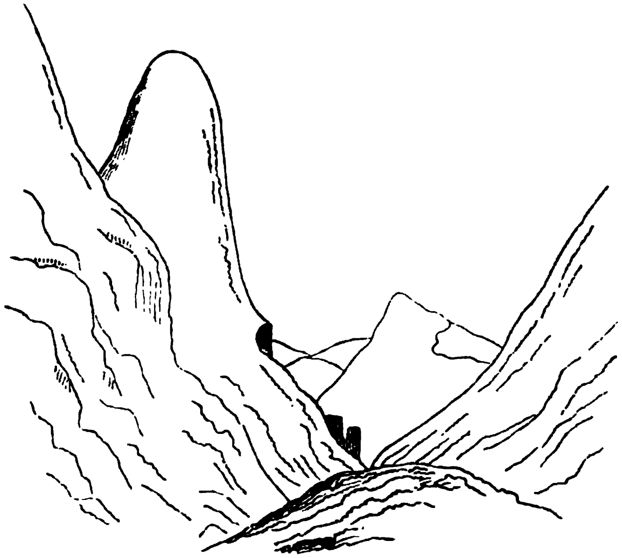
I again reached the grand Sogne Fjord, at Ruttledal, near its mouth, and crossed to Leervik, where there is a good inn. It is beautifully situated at the head of a small tributary of the Sogne Fjord, named the Bo Fjord, the rocky sides of which are very precipitous, rising to a great height above the clear blue water. I was informed by the landlord of the inn, a very intelligent man, who speaks English well, that when the Government were sounding for the purpose of laying the telegraph from Bergen to Molde and Trondjem, the Bo Fjord proved to be 800 fathoms in depth. He had previously told this to the surveyors, having been already aware of it; for he used to fish with hand lines, and caught *whiting, pollock,* &c., at this depth. The Sogne opposite Ruttledal was 500 fathoms, while the sea itself opposite the mouth of the great Fjord was only 200 fathoms. Some of the Scotch lochs also are much deeper than the sea outside.

From Leervik I went by steamer to Vadheim, some twenty English miles up the Sogne Fjord. At this place there are fine terraces of sand and gravel at the mouth of the valley, which opens into the Vadheim Fjord, another small branch of the Sogne; these terraces extend for some miles up the valley. There are also two picturesque lakes, which seem to be rock basins, very deep, particularly at the southern ends, where the barrier is rock, and not drift; at the northern ends they shelve very gradually, and have a fine sandy bottom. The rocks are all rounded, furrowed, and striated in the direction of the valley. According to Professor Ramsay's theory of glacial lakes, these rock basins must have been scooped out of the gneiss rock by ice moving northwards; so that in coming from Vadheim to these lakes I had passed an *ice-shed,* from whence the ancient ice moved northward to the valley of the Dals Fjord, and southward to the Sogne Fjord. The present watershed between these two valleys is north of the lakes; and if no alteration has since taken place in the form of the ground, the ice, after ploughing out the rock basins, must have then scaled the ridge to the north of them. Between Sande and Förde some fine peaked mountains were passed on the west, but the names are not given on Munch's Map. (See figure 5). At Förde there are very well defined terraces. From this the route trends eastward, up the valley, to the Julster Vand—another grand specimen of a rock basin.

There is a very clean neat station here at Nedre Vasenden; it would be a very good stopping place for one visiting the glaciers at the north-west side of Jöstedal Breen, and a day might be well spent in sounding the lake. I took boat up it from Nedre Vasenden to Skeid, at the eastern end; before reaching which the mouth of a long narrow creek, with steep rocky sides, was passed. Looking up this I could see, high

up at the head of the valley, above the farm of Sognesand, a shining glacier, one of the tongues of Jöstedal Breen. It appeared in the distance to have a very steep incline, probably 40°, and to end in an abrupt snout, at the foot of which was a terminal moraine.

Fig. 5.



The scenery between Skeid and Forde, the next station, is very grand and varied; high hills with snow, waterfalls, and rock basins, with steep sides glaciated to the summit.

Crossing a watershed, we descend to Förde, situated at the head of the Bradheims Vand, another rock basin in one of the transverse valleys of the Nord Fjord. The outline of the hills here is very fine, and a good deal of snow was visible. I took boat down the lake to Reed. Landing there, I proceeded for a few miles eastward up a valley, and then turned to the north, crossing the Fjeld to Utviken. On the way I had fine views of Jöstedal Breen, with Lodals Kabe rising above the snow. From thence I took boat across the Nord Fjord to Faleide, which is an excellent station: it would be a good stopping place for those visiting Jöstedal Breen. The steamers from Bergen call here once a week. From this I went by Grodaas to Hellesylt, at the head of the Lunelos Fjord, a branch of the Star Fjord. The views on the way are very fine; on the left hand were some peaked hills, with snow. I observed several landslips of recent occurrence.

Next day I went by the boat four miles down the Fjord, landing at Sjoen; my destination was Soholt, on the north side of the Stor Fjord.

I could have gone all the way by water, but I preferred the Fjeld; so I took the road from Sjoen to Slyngstadt, situated on the south side of the Fjord. The ascent is very steep from Sjoen to the plateau of the Fjeld, the road winding in zigzags for two miles, or so. There is an equally steep descent on the other side of this Fjeld into the valley below, and then there is a good road to Slyngstadt. In this valley there are very distinct terraces, forming parallel roads.

From Slyngstadt I went by boat down the Stor Fjord to Andam, on the north side—a beautiful trip of some ten or eleven English miles. The scenery of these Fjords is all of the same type—smooth, glaciated gneiss rocks, rising steeply from the clear water. About halfway I saw two large birds of prey—probably ospreys—hovering about near their nest, which was perched on a high cliff. Landing at Andam, I walked to Soholt (three English miles), a prettily situated village, and a calling place for steamers. From Soholt, next day, I continued my journey to Vestness, some seventeen or eighteen miles distant, on the south side of the Molde Fjord. The scenery on this stage is quite alpine, with bold peaked hills, and snow. On getting near Vestness the magnificent peak of Romsdal's Horn, and the other hills at the mouth of Romsdalen, come into view. These peaks have the appearance of having escaped glaciation.

From Vestness I took steamer to Veblungsness, at the head of the Romsdals Fjord. The weather had now broken, and was most unfavourable for visiting Romsdalen, the great "lion" of Norway; but as I drove along in a carriole I could see that it was grand in the extreme.

Many travellers have compared Romsdalen with Glencoe in Scotland. If you could put some dozens more waterfalls into the later, add large patches of snow in the summer, red wooden houses in the valley, and high up the mountain sides, and then magnify the whole considerably, you might create a likeness. About Nysuten the grandeur of Romsdalen ceases. Near this place I observed in the gneiss rocks many beds composed exclusively of pink felspar, quartz, and black mica—in fact, beds of coarse-grained granite, interstratified with the gneiss; and numerous veins of black mica, occurring in large flakes, traversed the latter.

Between Molmen and Lasjoverk station is a lake, the Lesjoskogens Vand, which lies on the main watershed of Norway, and *has two outlets.* From its western end the Rauma, a considerable stream, flows northwards into the Romsdals Fjord at Veblungsness; and from its eastern the Laagen runs southwards into Mjosen Lake, and thence to the Glommen, which flows into the sea at Frederikstadt.

In the valley between Dombaas and Toftemoen there are great accumulations of drift, in the form of terraces and esker-like ridges, composed of fine sand, gravel, and boulders. The flat surface of a terrace on which the road runs near Toftemoen, was covered with *Tamarix Gallica:* this is in north latitude 62°. I believe its only station in

Britain is the south coast of Cornwall, north latitude 50°. In cultivated land about here the caraway (*Carum carui*) grows in great quantities; it is much used by the Norwegians in bread, and in their corn brandy.

Between Brendhangen and Rommundgaard, the two next stations, I saw several merlins. Here the valley narrows into a deep rocky gorge, somewhat like Pont Aberglaslyn, in North Wales, but on a much larger scale.

From the neighbourhood of Breden the scenery is rather tame till we pass Holnen station, beyond which the valley again narrows, and the road passes through a deep rocky gorge. Here I saw *Woodsia ilvensis*, and also *hyperborea* in great abundance; and there were plenty of strawberries and raspberries in fruit (August 9th) along the roadside. Among the birds I observed the wryneck (*Yunx torquilla*), the common redstart (*Motacilla Phœnicura*), the yellow wagtail (*Budytes flava*), and some finches, which were unknown to me.

Between Aronsveen and Lillehammer there are some fine terraces; there is a considerable amount of cultivation as we approach the latter. From this I took steamer down Mjösen Lake, which reminds one of Windermere on a large scale, to Eidsvold, and thence by rail to Christiania.

About Eidsvold there is a good deal of drift; the railway cutting shows a section in fine sand, resting irregularly on blue clay. The scenery along the railway is very varied—dense rich cultivated land, and wooded dells, reminding one of parts of the line from Plymouth to Penzance.

At Christiania I caught the steamer to Hull (August 11th), and bade adieu to Norway.

XI.—*Preliminary Notice of the Discovery of an Isomer of Sulphocyanogen.* By Dr. J. EMERSON REYNOLDS, Keeper of the Minerals.

[Read May 20, 1867.]

THE compound of cyanogen with sulphur, to which the name Sulphocyanogen* has been given, is a member of the singular class of bodies termed in organic chemistry "compound radicles."

Sulphocyanogen combines with metals, or electro-positive radicles, to form salts of definite composition, with which every chemist is familiar.

The chief interest of the matter is, however, that Sulphocyanogen itself has never yet been obtained; and, its isolation having never been effected, certain chemists adopted singular modes of regarding the constitution of the Sulphocyanides. For instance, Sulphocyanide of Ammonium may be regarded as NH_4, C_2NS_2, or NH_4S, C_2NS, or as an urea in which the oxygen has been replaced by sulphur. Thus :—

---

* C_2NS_2.

$C_2N_2H_4O_2$ urea,
$C_2N_2H_4S_2$ Sulphocyanide of Ammonium.

There are many and obvious objections to these views, which it is not necessary to enter into now; it is sufficient here to say that the radicle theory, if I may so call it, is that now generally accepted.

When commencing the experiments which led to the discovery of the singular body which I have now to describe, my object was to contrast carefully the decomposition of a Sulphocyanide of Ammonium in the presence of water, and under the influence of continued heat, with that of the *dry* salt when strongly heated.

The decomposition in the first case is well known to be as follows:—

$$NH_4C_2NS_2 + HO = NH_4O + H, C_2NS_2.$$

Now, what occurs when water is absent?

Baron Liebig, who has investigated this matter, states that, when Sulphocyanide of Ammonium is heated in a retort, it is decomposed with the production of bisulphide of carbon, sulphuretted hydrogen, ammonia, and a new compound (melam) thus:—

$$8\,(NH_4, C_2NS_2) = 4\,CS_2 + 8HS + 5\,NH_3 + C_{12}N_{11}H_9.$$

I find that, although this is the ultimate result of the application of a strong heat, yet, if it be cautiously applied for a very considerable time, a remarkable intermediate change takes place, which has hitherto been completely overlooked, even by so distinguished a chemist and close an observer as Baron Liebig.

If we place in a flask a quantity of dry Sulphocyanide of Ammonium, and apply heat by means of an oil bath, we find that as soon as the temperature reaches 147 C., the salt fuses to a nearly colourless liquid; if now we gradually increase the temperature to about 174 C., decomposition quietly proceeds; and we may then observe that a gas is given off, which on examination proves to be a mixture of hydrogen and ammonia. If the salt be kept in a state of fusion for two or three hours, quantities of the gaseous mixture will have been evolved, together with certain secondary products, which we might expect under the circumstances. On examination of the solid residue, when cold, we find that it is a mixture of two bodies—one, unchanged Sulphocyanide of Ammonium; and the second, the singular compound which I have now to bring under your notice. These are easily separated by crystallization, the Sulphocyanide being very soluble in water, and the new compound much less so. The latter is obtained perfectly pure by repeated crystallization.

Without now entering into the details of the analyses, which will be given in full in the complete paper, I find the composition of this body to be expressed by the formula—

$$C_2NS_2;$$

that is to say, it is identical in composition with Sulphocyanogen; but I will presently adduce facts to show that it is not really that body, but rather an isomer of it. The mode of its formation is very simple:—

$$NH_4, C_2NS_2 = NH_3 + H + C_2NS_2.$$

The solution of this body in water has a neutral reaction; it is soluble in alcohol, and in ether slightly; it fuses at 160° C. With dichloride of platinum a fine red precipitate is produced in the aqueous or alcoholic solution. On close examination with the microscope, the precipitate is found to be made up of pinnate crystals, very peculiar and characteristic in appearance. On analysis, these give results agreeing with the formula—

$$C_2NS_2, Pt\,Cl_2.$$

This salt, therefore, differs from those formed with platinic chloride by bases belonging to the ammonia type, in not requiring an atom of the hydrochloric acid, but in this respect it quite accords with the habits of certain of the bases of the urea series.

Dichloride of mercury also gives a compound similar in constitution to the last.

With nitrate of silver, a compound is formed, which is very readily decomposed into a mixture of sulphide of silver, and another substance, not yet examined.

With other metallic salts definite compounds appear to be formed; but in the presence of a free acid some of them speedily decompose, in certain cases with the production of a sulphide of the metal.

Having very briefly described the new body, and some of its compounds, before concluding, I may give my reasons for believing it to be neither a sulphide of cyanogen, in the ordinary acceptation of the term, nor Sulphocyanogen itself:—

1. It is not an *ordinary* sulphide of cyanogen, for nearly the same reasons that we consider Sulphocyanogen, as it occurs in its compounds, a distinct body—that is to say, the reactions of a true sulphide towards acids, many metallic salts, and the alkalies, are entirely wanting; again, it is very stable, and not prone to oxidation.

2. It is not Sulphocyanogen, since it does not combine with hydrogen to form hydrosulphocyanic acid, or with ammonia to form the Sulphocyanide.

Now, what I believe this singular body to be is a slightly basic substance, *isomeric*, but not identical with true Sulphocyanogen. This, however, is but an hypothesis, to be proved or negatived by the further investigation of the properties and relations of the new body.

XII.—THE DARIEN CANAL LINE. By DR. CULLEN.

[Read May 22, 1867.]

THE revolt of the Spanish Colonies in South America against the mother country began in Venezuela, in the year 1810. In 1819, at the Congress convened at Angostura, on the Orinoco, by Simon Bolivar, the Liberator, a decree was passed, constituting the Republic of Colombia, by the union of the former Captain-Generalship of Venezuela and the Viceroyalty of New Granada; and soon afterwards Ecuador, the country between New Granada and Peru, joined the union.[*] By the separation of Venezuela, in 1830, and of Ecuador in 1831, Colombia was broken up into three independent republics. In 1861, after the taking of Bogotá (formerly Santa Fé de Bogotá), in the last of the numerous revolutions which have distracted New Granada, General Don Tomas Cipriano de Mosquera, the commander of the Liberal forces, altered the title of New Granada to that of the United States of Colombia, of which he is now President. It is to this republic that the Isthmus of Panama and Isthmus of Darien belong.

The eastern third is the Isthmus of Darien, the central part the Isthmus of Panama, and the western the Isthmus of Veraguas, which gave the title of Duke of Veraguas to Columbus and his descendants. The late Duke of Veraguas and Count of Jamaica, Don Pedro Colon, who was the lineal descendant of Columbus, was President of the Cortes of Spain, and died a few months ago.

The only part of this great Isthmus, which is 360 miles long, and averages 60 miles in breadth, that can be said to be known, is the line of the Panama Railroad. This may be called a great work, if only in consideration of the stupendous difficulty surmounted in carrying it for twenty-six miles across a swamp, a veritable slough of despond, which necessitated the making of land all that way, and the renewal of the piles, owing to their rotting away two or three times. All this difficulty would have been avoided had the promoters selected a line a few miles to the east of it, which I had proposed to their consideration, and along which they could have constructed the railroad on low but dry and firm land. The mortality amongst the coloured labourers was considerable, but has been very much exaggerated; amongst the white labourers it was only one per cent. per annum.* It was chiefly owing to the fact that the labourers were always in wet, standing during the day, and lying at night, in swamp sludge. The railroad was commenced in 1850, and opened for traffic January 28, 1855. It commences at Aspinwall, or Colon, in Navy Bay, on the Atlantic; and ends at Playa Prieta, just outside the walls of Panama. Its length is 47 miles, 3020 feet; the summit ridge is 287 feet above the mean tide of the Atlantic, and has been cut down to 262 feet. The construction account, closed in December, 1858, was eight millions of dollars, or £1,600,000, a considerable part of which was for the renewal of the rotten piles. The company pays a dividend of about forty per cent. per annum. The harbours on this line are very bad; Navy Bay being open to all winds from the north-west to the north-east, round by north; and the north being the prevalent wind, which sometimes blows there with great fury; whilst the anchorage off Panama is five miles out from the shore—a sandbank, which is dry at low water, preventing the nearer approach of large vessels.

---

[*] The last battle of the War of Independence was fought on the 9th of December, 1824, at Ayacucho, in Peru, where the Spaniards, under the Viceroy, Canterac, were defeated by the Colombians and Peruvians under General Sucre. The last stronghold of Spain in Central America was the Castle of San Juan de Ulloa, in the harbour of Vera Cruz, which, after a very prolonged defence, was surrendered by General Don José Copinger to General Santa Anna on the 15th of September, 1825. The Spanish flag waved for the last time on American soil on the 29th of January, 1826, when the garrison of Callao, in Peru, under General Rodil, surrendered by capitulation to General Sucre.

The Isthmus of Darien is covered throughout with a dense forest of tall trees, containing some of the most valuable timbers, and with a close undergrowth of shrubs. The trees support numerous trailing vines, or creepers, which ascend to their tops, and fall in matted festoons, forming a perpendicular wall of foliage; whilst parasitic plants in great numbers and of every form, cling to their trunks, encircling them with flowers of every hue. This luxuriant tropical vegetation grows in a soil of such fertility that it would serve for manure for less favoured lands. Its density, however, is a great impediment to the explorer, as it renders it impossible to obtain anything like an extensive view, or even to see more than a few yards ahead.

The Cordillera traverses the entire length of the Isthmus, rising at less than three miles from the Atlantic coast by a sudden and steep ascent to a narrow and well-defined summit, and falling more gradually to its foot on the Pacific side, the breadth of the base being three miles. Inland of Caledonia Harbour a break occurs, one ridge commencing and another terminating thereabouts. As their extremities overlap each other, the valley inclosed between them is so oblique in its direction, that it is only visible from one point of view. Its existence has therefore escaped observation, and the Cordillera has hitherto been regarded as a continued and unbroken chain.

The Atlantic coast, and the country for about eight miles inland, is very sparsely inhabited by the Darien Indians—an independent tribe, who have always opposed every attempt made to penetrate their country, or even to land on the coast: their total population in all Darien I estimated at from 2000 to 3000 souls. The only inhabited place on the line of the proposed Canal was the hamlet of Sucubti, which had fifty inhabitants; but it was abandoned in 1854, and the line is now totally uninhabited. In all the south of Darien there is a population of only 1209 negroes, who are citizens of the United States of Colombia, and speak Spanish. The Indians do not permit them to cross over towards the Atlantic, whilst they themselves never visit the Pacific side; so that the whole of the intermediate country is never traversed except by some stray Indian on a hunting excursion. Although the first settlement on the Continent of America was Santa Maria la Antigua del Darien, founded by the Bachelor Enciso, by the advice of Vasco Nuñez de Balboa, near the mouth of the Atrato, at the east end of this isthmus, there is now, strange to say, neither path, track, trail, nor way of transit of any kind across any part of the Isthmus of Darien, and the only open spaces in it are the courses of the rivers.

---

* Mr. David Hoadley, President of the Panama Railway Company, in his Report to the Directors, in 1858, says:—"The first blow on the work was struck in January, 1850. Since then a strict record has been kept of the deaths which have occurred amongst the white men employed by the Company; and up to the time of opening the road, on the 28th of January, 1855, the number was 293, of which many are known to have been caused by diseases not incident to the climate. How many white men were connected with the work during this period cannot be accurately determined; but the number was at least 6000."

A party of explorers and surveyors having been lately dispatched to the Isthmus of Darien by the Government of the United States, in accordance with an act passed by the last Congress, for the purpose of searching for a line for a Ship Canal to unite the Atlantic and Pacific, a brief description of the only line which appears to me to be practicable may be interesting at the present moment. As the project of a Canal across Darien was brought before the public fourteen years ago, and then dropped, it will at once be asked, why it has lain in abeyance since then? It must be explained, then, at the outset, that in 1849, on returning from a journey to the Sierra Nevada of California, I first explored the line, and made a more particular examination of it in each of the three following years. In 1852 a short *reconnaissance* was made at each side by an engineer sent from London. In 1853, in consequence of his favourable report, the Atlantic and Pacific Junction Company of London was formed. In 1854, a large staff of engineers, most amply provided with funds, instruments, and necessaries of all kinds, was sent out by the Company to survey the line; and three British, a French, and an American ship of war were stationed in the harbours to assist them. *Six weeks before their arrival* in Darien, another party landed on the Pacific side, and attempted to cross over to the Atlantic; and *two days before their arrival*, a third party landed on the Atlantic side, with the intention of penetrating the country. Thus, instead of a single well-arranged plan for making a thorough examination of the country, there were three unconnected explorations in different and—unfortunately—wrong directions, of which two were conducted without the use of compasses! or even bush knives, and not one was brought to a conclusion. In each case, moreover, the commanders were guided by agents sent to offer their gratuitous services by the Atlantic and Pacific Ship Canal Company of New York, the promoters of which at that time proposed to cut a canal by the Atrato route, which Humboldt had recommended on the authority of the Biscayan pilot, Gogueneche. Acting upon information sent by some persons in the confidence of the London Company to the promoters of the Atrato Company, those agents knew where and when to find the commanders, so as to be in time to start along with them. Thus Commander Prevost was guided by Messrs. Kennish and Nelson; Lieutenant Strain, by Messrs. Avery and Boggs, of the Atrato Company, and by Messrs. Holcomb, Winthrop, Foster, and Bird, of the Panama Railroad Company; and Mr. Gisborne, by Colonel Augustin Codazzi, who, although in the service of the New Granada Government, as chief of the Chorographic Commission, was also in the pay of the Atrato Company, and had just sent a most favourable report of the route to New York. Although not one of these gentlemen had ever before set foot on the Isthmus, and, although I accompanied the expedition, yet, as the Directors of the Company had refused to give me any position or authority in the conduct of the expedition which had been sent out to promote a project that had originated with me, I was not permitted to interfere in any manner whatever; and not only were my offers to act as guide refused, but the course taken was directly opposite to that which I had pointed out, as is fully shown in my pamphlet, entitled, "Over Darien—Reports of the Mismanaged Darien Expedition," and published by Wilson, of the Royal Exchange, in 1856.

The result was, that the Engineer-in-chief, in his Report to Lord Wharncliffe, the Chairman of the Company, dated Her Majesty's Ship "Espiegle," Caledonia Harbour, April 4, 1854, stated that a tunnel of three miles would be necessary, although the same Report concluded as follows:—"I am quite aware that, in now concluding my surveying operations, there is a great deal of interesting information still wanting, and that my examination of the Isthmus is not near so perfect as I had hoped to make it." This, indeed, had been so manifest, that Commander Parsons, of Her Majesty's Ship "Scorpion," writing to me some time afterwards, said, in allusion to the above Report:—"I wish the summit level of the Isthmus had been a little less. . . . *Of course I shall not consider the matter thoroughly settled until further search is made.*"*

The same opinion of the imperfect and partial character of the inspection of the country then made was expressed by Baron Humboldt, M. Malte-Brun, M. Michel Chevalier, and T. C. Vincent, Esq., of Southwark, who spent several months in Bogotá examining the archives there, in search of the accounts of the attempts made by the Spaniards to open a road across Darien.

More recently, J. Gerstenberg, Esq., F. R. G. S., in the discussion on Mr. Oliphant's paper on the Bayanos River, read before the Royal Geographical Society, on the 24th of April, 1865, said:—"The only route that I believe to be practicable is the Darien route. . . . Dr. Cullen and Commander Parsons have stated that there is a valley running through the main ridge to Caledonia Harbour. The only point to be settled is the existence of this valley, which subsequent explorers failed to find, because they did not wish to find it, owing, as I believe, to the jealousy of the Panama Railroad Company, and of the *concessionaires* of the Atrato route, who had rival interests, and consequently did not desire that the transverse valley should be found. In the Hydrographical Map of Parsons' 'Survey of Caledonia Harbour and Port Escocea,' he gives several views of the Cordillera; and View 3 clearly shows that the Cordillera at that point is not an uninterrupted chain, but is broken into two separate and distinct mountain ridges, between which a valley may naturally be expected."

---

* "Letters on the Darien Ship Canal." London: Effingham Wilson, 1857.

The above-mentioned Report, however, arriving just at the outbreak of the war in the Crimea, determined Lord Wharncliffe and the directors to dissolve the company, whereupon the project fell to the ground, and has lain in abeyance ever since.

It will be found, nevertheless, upon a survey being made by competent engineers, sincerely desirous of the success of the project, that by following the course laid down in this paper the necessity for a tunnel can be avoided.

The Harbours on each side afford secure anchorage both in the dry and the rainy season, are safe and sheltered from all winds, have great depth of water, and immense capacity, and are easy of ingress and egress. Along the Atlantic coast a continuous series of good anchorages extends, twelve miles in length, and from three-fourths of a mile to a mile in breadth. These are from N. W. to S. E—1. The Channel of Sassardi, 2½ miles long, the entrance of which is between Sassardi Point and one of the Sassardi Islands. 2. Caledonia Harbour, 3½ miles long, the entrance of which is between Isla de Oro, or Golden Island, and San Fulgencio Point. It is separated from the Channel of Sassardi by a narrow bar of 12 feet. This could easily be removed, as the boring made by the engineers penetrated into marl 15 feet. By cutting it through, the two harbours would be converted into one, which would have the advantage of an entrance at each end. A considerable river, which rises in the valley between Sassardi and Agla Mountains, falls into this harbour, 2¾ miles N. W. of San Fulgencio Point. The little River Sassardi, at the mouth of which is the Indian village of the same name, falls into the N. W. extremity of the Channel of Sassardi. 3. Caledonia Bay, an open roadstead, three miles long, with a sea beach, near the middle of which the Rivers Aglaseniqua and Aglatumati disembogue. 4. Port Escoces, which is three miles in extent inwards. It was on the inner side of the promontory that shelters it that the Scotch colonists of 1698 built the town of New Edinburgh and the fort of St. Andrew. The canal which they dug round the fort is still quite perfect; it is 130 paces in length, and is cut angularly like a fortification, with an embankment on the inside: the north entry is excavated through rock, and is eight feet deep, and twelve feet wide. Some mounds, which may be ruins of houses, or graves, indicate the state of the settlement. All the above anchorages, except Caledonia Harbour, are completely sheltered.

On the Pacific side, the great Gulf of San Miguel has an extent inwards of 22 miles, and a breadth of from 4 to 20 miles. An inspection of the "Survey of Caledonia Harbour and Port Escoces," by Commander Parsons, of Her Majesty's Surveying Ship "Scorpion," and of Captain Kellett's "Survey of the Gulf of San Miguel" (on Sheet 1, West Coast, Central America), both published by the Admiralty in 1854, will show how admirably the harbours on each coast are adapted for the termini of a grand interoceanic canal.

Into the inner extremity of the Gulf of San Miguel, the great River Tuyra* disembogues by two mouths—Boca Chica and Boca Grande, in each of which there is a depth of 13 fathoms at low water. Immediately above its mouths there is an estuary, into which the Savana River opens from the north. This estuary forms an inner harbour, which is eight miles in length, has a breadth of three miles, and a depth of more than 13 fathoms, and is perfectly landlocked. Of the advantageous position and capabilities of this harbour the Emperor Napoleon, at the last audience with which he honoured me, expressed a most favourable opinion, and suggested that it should be named "Port Interieur du Darien."

THE LINE FOR THE CANAL.

It is essential to state, *in limine*, that the whole Isthmus is covered throughout with a dense primæval forest, extending down to the sea from the summits of the highest mountains, and only broken by the courses of the rivers. This will account, in part, for the failure of the parties in 1854 to find their way, and for "the extraordinary conclusions at which they arrived with regard to their supposed positions," referred to by Commander Parsons in the "Sailing Directions" accompanying his chart.

The line first crosses a narrow plain, extending from Caledonia Harbour to the entrance of a valley or pass between the two mountains of which the Cordillera consists at that point. Caledonia *Harbour* must not be confounded with Caledonia *Bay*, which is to the S. E. of it, for a line across the plain from the latter would encounter the mountain.

It then traverses the valley to its other extremity, where it strikes upon the River Sucubti.

The course of this river is next followed down to its mouth in the Chuquanaqua, which is a tributary of the Tuyra.

Lastly, crossing the Chuquanaqua, the line traverses the forest to the junction of the Lara with the Savana.

From that point there is an easy and uninterrupted navigation of sixteen miles, to the confluence of the Savana with the estuary of the Tuyra, which, as before stated, discharges itself into the Gulf of San Miguel.

---

* Tuyra is the name of the devil in the languages of both the Darien and Caribbee Indians, by both of which tribes he was formerly worshipped.

The following are the courses by compass, and the distances in English miles between the principal points along the line:—

1. From the bight N. W. of San Fulgencio Point, Caledonia Harbour, to the entrance of the valley, 2 miles S. by W. ½ W.
2. Through the valley to the Sucubti River, about 3½ miles, S. E. ¾ E.
3. From the head of the Sucubti to Sucubti Hamlet (or its site, as it was burned and abandoned in 1854), about 2½ miles S. W. ¾ S.
4. From the site of the hamlet, down the bed of the Sucubti to the confluence of the Asnati with it, 7 miles W. S. W. In this portion the Napsati falls into the Sucubti, 2½ miles above the Asnati.
5. From Asnati mouth the line continues to follow the Sucubti down to its confluence with the Chuquanaqua, on the east bank of which it opens, 11½ miles W. ¾ N.
6. From the west bank of the Chuquanaqua, opposite the Sucubti mouth, and below those of the Artuganti and La Paz, to the confluence of the Lara with the Savana, it runs 15½ miles, S. W. ¼ W.

The tide of the Pacific rises 14 feet at the mouth of the Lara, and 6½ feet at its bifurcation, 3¾ miles higher up. It also flows up the Savana for about eight miles above the Lara mouth.

The length of the line is 42 English miles, whereof more than 21 are along the course or bed of the River Sucubti, of which at least 12 miles would admit of being canalized, by means of dams and embankments, for a moderate outlay, leaving the length of canal required 30 miles, from which three may be deducted for the windings of the Sucubti that would be cut across.

The entire line of transit from sea to sea will then consist of—canal, 27; canalized river, 12; navigation of the Savana, 16; and of the Tuyra, 3—in all, 58 English miles. This distance could easily be traversed within 24 hours, even making a liberal allowance for the time that would be occupied in the passage of several locks.

The direct distance from Caledonia Harbour to the Savana is 32½ English miles, and the course is S. 62° W. (S. W. by W. ½ W.), true, or S. W. ¾ W. by compass, ¾ of a point to the right being allowed for the variation, which was 8° 50′ in 1854. The variation is increasing at the rate of, probably, a quarter of a minute each year, and may now be assumed to be 8° 53′ E.

The distance from Caledonia Harbour to the highest point on the Lara, to which the tide reaches, is less than 28 miles; and the length of the canal might be lessened by two or three miles, by dredging a few miles of the lower part of the Lara, and commencing the canal from its bifurcation.

THE LEVELS.

Not a single level has ever been taken along the line, and all I can offer is a mere approximate estimate of the elevations of a few points.

The valley runs between Sassardi Mountain, on the N. W., and Mount Agla on the S. E., these two being distinct mountains, although from the overlapping of their extremities they appear to form a single unbroken chain. As they both run nearly parallel to the coast, the valley also has the same direction, and is therefore so oblique in its course that it is not visible from the coast. Hence it escaped notice, and its existence was ignored by the Engineer-in-chief, who proposed to tunnel Mount Agla, whilst my idea was to make a detour round its N. W. extremity, and so avoid it altogether.

About halfway through it there is a ridge, which is the lowest summit level between the waters flowing into the Atlantic, and those flowing into the Pacific. It is the watershed between the Sucubti and a river, that falls into Caledonia *Harbour*, 2¾ miles N. W. of San Fulgencio Point, and 4 miles N. W. of the Aglatumati. This last, which Mr. Gisborne called Caledonia River, falls into Caledonia *Bay*, and should be avoided, as there is no pass from it across the Cordillera.

The ridge halfway up the valley, and about four miles from the landing place, is then the most elevated point on this line between the two oceans, and the determination of its height is the most important problem to be solved. In my opinion it does not exceed 200 feet, and it may be less.

The elevation of the bed of the Sucubti from its head down to its mouth, probably falls from about 180 to 70 or 80 feet, which may be the height of the bed of the Chuquanaqua, where the line crosses it.

From the Chuquanaqua there is a gradual ascent for seven miles to a height of perhaps 130 feet, and then a descent for eight miles and a half to the Savana.

It is evident from the above statement that our knowledge of the elevations of the principal points along the line is merely hypothetical, and that an entirely new field lies open here for the operations of the surveyor.

The most important elevation to be ascertained is that of the ridge, which is only four miles, or two hours' walk, from the landing place in Caledonia Harbour, and which may admit of being cut down to such a depth as to reduce considerably the amount of lockage that would otherwise be required.

GEOLOGY.

The material to be excavated consists of alluvial deposit, of very great depth, clay, gravel, and rock. "The shores and the sides of the smaller hills," says Commander Parsons, of Her Majesty's Ship "Scorpion," in the "Sailing Directions," accompanying his "Survey of Caledonia Harbour and Port Escoces," "are composed of an accumulation of coral deposit, forming in some places a loose kind of coralline limestone, but in general being disconnected. This structure is found to some distance inland, on removing the substratum of alluvial deposit, rendering it probable that the low land from the base of the hills has been formed by drift or upheaval in no very remote age."

The soft material which I saw removed by Captain Hollins, of the "Cyane," in boring for a well near San Fulgencio Point, was dolomite or magnesian limestone (magnesia, 48; lime, 52). I can say no more on this point, except that there are rounded pebbles in the beds of the smaller rivers and that some of the large rivers are crossed, high up, by ledges of a kind of slate, or coarse argillaceous schist, called pizarra in Spain, and killas in Cornwall. Unfortunately, the boring instruments brought out in 1854 were not even landed; and the same thing happened in the case of the French expeditions of 1860 and 1861, the instruments not having been brought on shore.

ENGINEERING.

There would be no work to be done in the harbours, or the approaches to the Canal, except the erection of lighthouses, the placing of buoys, the deepening of the bight of San Fulgencio* for a quarter of a mile from its present depth—twelve to twenty-four feet—to a uniform depth of thirty feet; and, perhaps, some dredging in the Savana for a mile or two below the Lara mouth. With these trifling exceptions, the whole amount of work to be done would be to cut a canal, twelve or thirteen miles in length, from Caledonia Harbour to the mouth of the Asnati; to canalize the Sucubti from thence to the Chuquanaqua, a distance of eleven miles and half; and to cut a canal from the Chuquanaqua to the Savana, a distance of fifteen miles and half. There would be two summit levels—one of, say, 180 to 200 feet, between Caledonia Harbour and the Sucubti, and one of, say, 100 to 120 feet, between the Chuquanaqua and the Savana. A most abundant supply of water for the highest levels could be obtained from the Foreti, the head of the Sucubti, the Moreti, Asnati, Napsati, Chueti, Jubuganti, Artuganti, and several other rivers; each of which pours forth, in the driest season, a volume of water far beyond what would be required for the Canal. In this and many other respects the country offers every facility for the construction of a canal with locks.

The height of the summit levels, the number of cubic yards of earth and rock to be excavated, the nature of the latter, and the number of locks that will be required have yet to be ascertained. The width of the Canal will also be a point to be considered by the engineer, who will have to decide whether it would be better to make it wide enough for the passage of two ships abreast, or of one only, with lie-by places at which ships might pass each other.

However scanty and incomplete the information that can now be offered on this line may appear, it is yet sufficient to prove that, besides the pre-eminent recommendation of being provided with excellent harbours at each terminus, it has the additional advantages of shortness, low elevation, and healthiness. I therefore consider myself justified in asserting it to be the most eligible route for interoceanic communication; and I am confident that, when as admirable a survey shall have been made of it as those of the Panama, Nicaragua, and Atrato routes, by Garella, Childs, and Michler, it will be found to require a lesser amount of excavation, and fewer locks than any other of the proposed interoceanic routes.

---

* There are other points, however, where there is much deeper water, close in shore.

Considering the rapid strides that engineering science has made of late, it would be quite unnecessary to advance any arguments to prove that there is nothing "stupendous" in this undertaking. It is enough to allude to the Languedoc, Erie, Ganges, East Jumna, West Jumna, and Baree Doab Canals, and to the great canalization and irrigation system in China. In comparison with any one of those great works, long ago completed, the proposed Canal in Darien seems quite a trifling undertaking.

COST.

There are no data upon which to frame an estimate of the cost of the work. A rough approximate calculation has, however, been made under the following circumstances. Having, in 1857, presented all the plans and documents bearing on the matter to the Emperor of the French, His Majesty, after examining them, forwarded them to Count Walewski, who appointed a commission of engineers of the Corps des Ponts et Chausseés to study the question. The result at which they arrived, after an investigation which occupied three weeks, was that the Canal was practicable without a tunnel, and could be completed for about 150,000,000 of francs, or £6,000,000 sterling. The estimate more recently made by M. Moguel Bey, the chief of the corps, also amounted to about the same sum, as stated in a work published in Paris, in 1864, under the title of "Percement de l'Isthme Americain par un Canal Interoceanique par la Ligne du Darien."

The detailed and admirable survey of the Panama line made in 1844 by M. Garella and M. de Courtines, by the orders of Louis Philippe, and published under the title of "Projet d'un Canal à travers l'Isthme de Panama," in 1845, will, also, afford some idea of what it may be. The line surveyed was from Navy Bay to the little bay of Vaca del Monte, twelve miles and half west of Panama. Its length was forty-seven miles and half; and the lowest summit level found by Garella was Cerro Ahogayegua, 456 feet above the level of the oceans. Since that time a much lower level has been found. The estimate made was for a canal, 23 feet deep, wide enough for two ships to pass freely, except at the summit, with locks 46 feet 6 inches wide, and 208 feet in length between the aprons, and a tunnel through rock, 3 miles, 516 yards long, at the elevation of 135 feet above the level of the ocean, high enough for vessels of 1200 tons, burthen to traverse it with their lower masts standing, to which water was to be conveyed by means of open trenches, 1·65 feet deep, and 61 miles long. The estimate of the whole cost of the work, including the tunnel, 3 large and 3 small aqueducts, a pier 1083 yards long, 36 locks, and the formation of an entrance basin at Vaca del Monte, amounted, at 9s. per cubic yard, to £5,000,000 sterling.

MEAN LEVEL OF THE OCEANS.

A great difference of level was long supposed to exist between the two oceans, as well as between the Mediterranean and the Red Sea; but in both cases more complete investigations have shown the belief to be unfounded. In 1855, a series of observations, made by Colonel Totten, the Chief Engineer of the Panama Railroad, on the height of the tides and the levels of the two oceans—in Navy Bay, on the Atlantic, and in Playa Prieta, a deep bight in the Bay of Panama, on the Pacific—established the fact that the difference of the mean level, if any, is very trifling. The results are given in the following Table:—

	PACIFIC.		ATLANTIC.
	May and June.	November and December.	August and September.
	Feet.	Feet.	Feet.
Greatest rise of tide, ...	17·72	21·80	1·60
Least, " "	7·94	9·70	0·63
Average, " "	12·08	14·10	1·16
Mean tide of Pacific *above* mean tide of Atlantic, ...	0·759	0·140	
High spring tide of Pacific *above* high spring tide of Atlantic, ...	9·40	10·12	
Low spring tide of Pacific *below* low spring tide of Atlantic, ...	6·55	9·40	
Mean high tide of Pacific *above* mean high tide of Atlantic, ...	6·25	6·73	
Mean low tide of Pacific *below* mean low tide of Atlantic, ...	4·73	5·26	
Average rise of spring tides, ...	14·08	17·80	
Average rise of neap tides, ...	9·60	12·40	

Colonel Totten thus concludes his Report:—"Although my observations make the mean level of the Pacific from 0·140 to 0·759 feet feet higher than the mean level of the Atlantic, this is probably owing to local circumstances alone. We may, therefore, decide that there is no difference in the mean *level* of the Atlantic and Pacific Oceans." Colonel Totten, it must be observed, was able to test the accuracy of his levelling across the Isthmus upon the finished bed of the railway, an advantage not possessed by previous observers. The result of the difference of the rise of tide is, that there is a perpetual oscillation—

sometimes the one, and sometimes the other sea being higher—except at mid-tide, when both are on a level. At high water the Pacific is several feet higher, and at low water several feet lower than the Atlantic. The time of high water is nearly the same on both sides, namely, at $3^h\ 20^m$ at full and change.*

As the Canal must have a few locks, the difference in the rise of tide would have no bearing whatever on the question of its practicability.

The SEASONS are the dry and the rainy. The former, which corresponds with the season of the breezes, or strong N. E. trade winds, lasts from December to May; the latter commences in May, and continues till December, with fine weather at intervals.

Of the WINDS, Commander Parsons, R. N., says:—"The prevailing wind here is from N. N. W. to N. N. E. This is the trade wind, which, turned from its direction by the high land of the Continent, and finding a void in the Gulf of Darien, rushes in to fill it. From January to April we had it constantly blowing in this direction, with an approach to calm at night. In the rainy season the wind ceases at night, and a land wind blows from the mountains, with occasional squalls with rain from the S. W.; but I should think it would seldom blow with any force from the S. E. or E.

"Hurricanes are unheard of in this quarter.

"Earthquakes must be rare, as the Indians do not recollect the ground shaking at any time. This fact would be favourable to the permanency of a ship canal when once established."

CLIMATE.

From the total absence of swamp, marsh, or fen along the line, and the great number of rivers and rivulets (*quebradas*) with rapid currents, which drain the adjacent country, and prevent the lodgment of stagnant water in its vicinity, I consider the country to be healthy, and would not apprehend the occurrence of malarious fevers amongst European labourers, if of temperate habits. The reports of Dr. M'Dermott, of H. M. S. "Espiegle;" Dr. Brownlow, of the U. S. Corvette, "Cyane;" Dr. Rondat, of the French war steamer "Chimere;" and Dr. Ross of H. M. steamer "Virago," show that, amongst 900 men who composed the crews of the vessels which lay at anchor in Caledonia Harbour, and 250 men of the "Virago," which was stationed in the River Savana in 1854, not a single case of sickness occurred during the three months of their stay; whilst the convalescence of those who were sick on the arrival of the vessels there was unusually rapid. Commander Parsons, too, says:— "During our stay, from January to April, we found the climate to be healthy, having had no cases of fever, although the men were greatly exposed." Lastly, Mr. Gisborne, in his Report to Lord Wharncliffe, the Chairman of the Atlantic and Pacific Junction Company, dated H. M. S. "Espiegle," Caledonia Harbour, April 4, 1854, says:—"There have been altogether in this surveying expedition 900 persons subject to climatic influences, some along the coast, and some in the interior, and I believe I am correct in stating that not a single case of illness occurred during the whole period of our stay."

---

* This refers to Navy Bay and Panama. In Caledonia Harbour it is high water, at full and change, at 11·40. The rise of tide there is 1 ft. 6 in. springs; 0 ft. 6 in. neaps. The rise and fall of tide in the Gulf of San Miguel is from 18 to 24 feet.

The opinion which I had previously expressed of the healthiness of the climate has thus been corroborated, and receives further confirmation from a document which I found in the course of my researches in the archives of Bogotá. I allude to the diary of Serjeant Gabriel Morales, who, with Serjeants Miguel Antonio Delgado and Miguel Quintana, commanded a detachment of 150 soldiers of La Princesa Regiment, who had a short time before arrived from Spain, and were sent to search for Indians by Lieut.-Col. Don Andres de Ariza, the Governor of Darien. They started from the fort of Principe, on the Savana, proceeded towards the Atlantic, and returned after an absence of 15 days in the height of the rainy season, without having seen any sign of an Indian. The diary concludes thus:—"25th of July, at noon we entered the Principe, and presented ourselves to the Governor, informing him that the whole of the troops had returned *in perfect health*, notwithstanding the terribly unfavourable weather they had unceasingly encountered, there not having been one fine day; and that all had used their best endeavours to fall in with the enemy, and returned disconsolate at not having succeeded therein. Puerto Principe, 25th July, 1786—Gabriel Morales."

POPULATION.

The only inhabited place on the line was the village of Sucubti, population 70, which was set fire to and abandoned by the people upon the approach of Lieutenant Strain, U. S. N., in January, 1854. As it was formerly the custom of the Indians to quit for ever any place which had been visited by an armed party of Spaniards, it is very likely that it has not been reoccupied. The only places within a distance of 10 miles from the line, are—Agla, on the Aglatumati, 3 miles from its mouth in Caledonia Bay, with 60 inhabitants; and Sassardi, Asnati, and Moreti, with about 50 or 60 each. Commander Parsons says of the people of Sassardi:—"During our stay, they were exceedingly friendly, however anxious to get rid of us. This they did not attempt to conceal, but expressed great gratification when told we intended to leave. All they wish is to be left alone; and they never allow any of the traders to penetrate the country, or scarcely even to land on the beach."

LATITUDES AND LONGITUDES.

	Latitude N.			Longitude W.		
	°	′	″	°	′	″
Escoces Point, ...	8	51	22	77	38	30
San Fulgencio Point, in Caledonia Harbour, .	8	53	37	77	42	15
Entrance of Valley, . .	8	52	7	77	44	15
Sucubti Hamlet (site of), .	8	47	30	77	48	45
Asnati Mouth, ...	8	46	—	77	49	—
Sucubti Mouth, ...	8	48	30	77	57	45
Lara Mouth, ...	8	41	45	78	7	—
Savana mouth, W. Point, .	8	28	30	78	5	—
Boca Chica, Turya Mouth .	8	28	45	78	8	—
Garachiné Point, Gulf of, San Miguel, . . .	8	6	—	78	22	30

San Fulgencio Point is 135 miles S. 78° E. (E. by S.) of Aspinwall, or Colon, in Navy Bay, the Atlantic terminus of the Panama Railroad; and Punta Brava, the north point of the Gulf of San Miguel is 78 miles S. E. by E. ½ E. of Panama.

MEMORANDA FOR EXPLORERS.

Before any attempt be made to land in Darien, the consent of the Indians should be obtained. If treated in a friendly and conciliatory spirit, they will offer no opposition. Some of the Sassardi people should be sent for Robinson, who was Secretary to Caloh-gwa, the late Chief of the San Blas Indians, and who resides at Carti, in San Blas Bay. He speaks English fluently, having been educated at Washington, at the expense of the late Daniel Webster.* He should be requested to invite the old men or chiefs of Sucubti, Asnati, Moreti, Sassardi, and Carreto villages to a conference, at which a treaty of friendship should be concluded with them, and their consent obtained to the making of a survey and the cutting of the Canal. If properly treated, they might provide guides through the forest, and furnish canoes for navigating the Sucubti, and hunters for killing game.

The best landing place is in the bight, N. W. of San Fulgencio Point.†

A light elongating ladder for ascending the trees on the summit of the Cordillera, and a stationary balloon, would be useful for the purpose of obtaining an uninterrupted view over the country.

---

* He was twelve years in Washington, and returned to Darien in 1858.

† The only *right* place to start from is the western extremity of the bight, in latitude 8° 58″ 45′; longitude, 77° 48″ 30″. By proceeding from thence a little more than half a mile to the west, and then south, true, for two English miles, the entrance of the valley will be reached. The Chief Engineer, in 1854, landed in Caledonia *Bay*, three miles south-east, and went up the Aglatumati, although I had advised him to land at Caledonia *Harbour* and told him that there was no pass from the Aglatumati.

A light boat should be carried across to the Sucubti, as it is probable that the hamlet, which was abandoned in 1854, has not been reoccupied, in which case it would not be possible to get a canoe there. Rafts should be constructed of the wood of the balsas, or other light timber, to convey the surveying party down the Sucubti.

The path from the Chuquanaqua to the Savana should commence about 2½ miles below the point opposite the mouth of the Sucubti.

The exploring party should be preceded by a sailor, having a ship's compass suspended in front of his breast by straps. Another sailor, with a compass secured in the same way, should bring up the rear. Every member of the party should have a pocket compass, and know or be taught how to use it.

Every one of the party, except the sailors with the compasses, should have a machete, or bush cutlass, with which he should notch the barks of the trees as he goes along, so as to make a *picadura,* or blazing. By taking this precaution stragglers will escape the danger of being lost in the bush, and in case of difficulty the party can at any time find their way back.

The distance should be measured by a chain, and every hour's course and distance logged. Observations for latitude and longitude should be taken at every important point, to serve as astronomical bases.

Ranchos, or sheds, made of poles stuck in the ground, and thatched with palm leaves, should be built at convenient distances. One of them can be made in an hour, as *guagaras,* or fan-leaved palms, are everywhere abundant. The bush and timber felled in making the paths should be burned as soon as possible.

Negroes accustomed to work with the machete (*macheteros*) can be engaged at Carthagena, Portobello, or Aspinwall. They are the best men for clearing bush and cutting paths; but permission for them to land should be obtained from the Indians, as they have a great aversion to negroes, at least Spanish negroes; possibly they might not object to Jamaica men.

The *Exploration* being ended, and the line to be surveyed marked out, the engineers can commence the *Survey.* Until that time the conduct of the affair should be intrusted to some persons experienced in exploring forests in the tropics.

The best time for exploring the Isthmus is from the beginning of December to the beginning of April: that being the dry season, the rivers are then low, and the heat is tempered by a N. E. sea breeze.

THE FOREST.

As the great difficulty in exploring the Isthmus consists in the density of the forest, which renders it impossible to see more than a few yards ahead, it is necessary to say that the trees are of all sizes, from 30 to 150 feet in height, and have between them a multitude of tall shrubs, and a close undergrowth of herbaceous plants. The trees support numerous trailing vines and creepers, known vulgarly as lianas, vehucos, nibbees (in Demerara), and bushropes (in the West Indies). These ascend to their tops, and fall in matted festoons, forming a perpendicular wall of foliage, which would delight the eye of the artist, but would totally impede the operations of the surveyor. Orchideæ, and other parasitic plants, in great numbers and variety of form, cling to their trunks, encircling them with flowers of every hue. Of palms, the most abundant species are the troolies (*Manicaria saccifera*), itas, or morichis (*Mauritia flexuosa*), and other fan palms, which occupy the largest part of the space between the tall trees. Another palm, very common, is the corozo colorado (*Eläis melanococca*), which yields an oil identical with the palm oil of commerce, the produce of its congener, *Eläis Guineensis*. The principal timber trees are cedar (*Icica altissima*), mahogany (*Swietenia mahogani*), lignum vitæ (*Guaiacum officinale*), silk-cotton tree (*Bombax ceiba*), raftwood tree (*Ochroma lagopus*), espavé (*Anacardium rhinocarpus*), bamboo (*Bambusa arundinata*), bullet tree (*Mimusops* sp.), crabwood (*Carapa Guianensis*), ebony (*Diospyros* sp.), hobo (*Spondias lutea*), ironwood (*Ybera puterana*), laurel (*Cordia gerascanthus*), locust (*Hymenæa courbaril*), mora (*Mora excelsa*), quiebra hacha, or break-axe (*Hymenæa pentaphylla*), quira (*Platymiscium polystachyum*), Tonquin bean tree (*Coumouroumа odorata*), and a very durable wood, called yaya. The quipo tree, too, is very common; it grows to a height of 70 or 80 feet, perfectly straight, and without any branches, except at the top; the bark is very thin, and the wood white, and exceedingly hard; it is, I believe, the caoba of Spanish, and the bastard mahogany of English woodcutters.

Monkeys, sloths, anteaters, dantas, machos del monte, or tapirs; a small deer, like the wirribocerra of Mexico, the sayno, warree, or white-lipped peccari (*Dicotyles labiatus*), the tatabro, or collared peccari (*Dicotyles torquatus*), the conejo, a kind of rabbit, and squirrels are plentiful.

Amongst the birds are flamingoes, parrots, pigeons, many varieties of humming birds, and three kinds of wild turkey—viz., the quam, guan, pava de monte, or crested wild turkey (*Penelope cristata*); the powhi, or crested curassow (*Crax alector*); and the powhi de piedra, or galeated curassow (*Ourax pauxi*).

CONCLUSION.

SAVING OF TIME AND MONEY.

The saving that would be effected by the adoption of this passage may be illustrated by the following comparison of the expenditure of time and money on the passage of a ship, with a crew of thirty men, from

New York to California, *viâ* Cape Horn, with what it would be by way of the Canal:—

Viâ Cape Horn.		Viâ Canal.	
Time, . . . 150 days.		Time, . . . 45 days.	
Salaries and finding of officers and crew, for 5 months, ...	5880 dols.	Salaries and finding of Officers and crew, for 1½ month, ...	1764 dols.
Insurance on 90,000 dols. (value of ship) for 5 months, ...	3600 dols.	Insurance on 90,000 dols. (value of ship) for 1½ month, ...	1080 dols.
Wear, tear, and depreciation, at 10 per cent. per annum, for 5 months, .	3750 dols.	Wear, tear, and depreciation, at 10 per cent. per annum, for 1½ month, .	1125 dols.
	13,230 dols.		3969 dols.

Difference in favour of the Canal, 105 days, and 9261 dollars. From England to California the saving would be somewhat greater.

With respect to the cargo, it would avoid the damage of goods going round Cape Horn—at present a very heavy percentage on their value. Supposing the value of the cargo to be 100,000 dollars, the saving would be as follows:—

Viâ Cape Horn.		Viâ Canal.	
Interest at 7 per cent. per annum for 5 months, .	2916 dols.	Interest at 7 per cent. per annum, for 1½ month, .	874 dols.
Insurance at 4 per cent., .	4000 dols.	Insurance at 2 per cent., .	2000 dols.
Total, .	6916 dols.	Total, .	2874 dols.

Difference in favour of Canal 4042 dollars.

The total gains of ship and cargo would therefore be 13,303 dollars, or about six per cent. on the value of both.

Rear-Admiral C. H. Davis, the Superintendent of the Naval Observatory, in his Report to the Secretary of the Navy on Interoceanic Communication, drawn up in accordance with a resolution of the last Congress of the United States, calculates, from the incomplete returns for 1857, that the saving to the trade of the United States, England, and France by the Canal route, if then open, would have amounted for that year to 48,130,208 dollars, or £9,626,041. He calculates the value of the ships and cargoes which would have passed through the Canal that year, if it were open, at 467,831,130 dollars, or £93,566,226.

TRAFFIC.

The following list is drawn up from the "Statistical Tables relating to Foreign Countries, compiled from the Official Returns of the respective Countries, Part 10," and from the "Statistical Tables relating to Colonial and other Possessions of the United Kingdom, presented to both Houses of Parliament, by command of Her Majesty:" London, 1866.

It represents the number and aggregate tonnage of vessels entered inwards and cleared outwards at Pacific ports, from and to Atlantic ports.

	Number of Vessels entered Inwards, and cleared Outwards.	Tons.
Aspinwall or Colon, Navy Bay, 1864,	588	483,805
[These ships would have passed through, if the Canal had been open.]		
Panama, 1864,	276	364,416
Punta Arenas, Costa Rica, 1864,	140	112,530
Guatemala,	No returns.	
San Salvador,	Ditto.	
Mexico, west coast,	Ditto.	
San Francisco, California, 1864,	922	675,481
[In 1858 the number of vessels was 2683, and the tonnage was 1,198,827 tons.]		
British Columbia, 1863,	Returns incomplete.	
Vancouver's Island, 1863,	1171	223,676
Honolulu, &c., Sandwich Islands, 1865,	151	67,068
[Entered only. Entered and cleared, in 1855, 640 vessels, and 455,790 tons.]		
Sitka and Russian America,	No returns.	
Kamtschatka,	Ditto.	
Ecuador, Guayaquil only, 1864,	406	104,771
Peru, 1865; Islay only,	74	33,952
[In 1855, 404,638 tons of guano were exported. In 1858, the total tonnage was 830,000 tons.]		
Chili, 1864,	2650	1,558,650
Tahiti, Society Islands, Port of Papeete, 1864,	206	21,361
Hong Kong, 1863,	294	214,138
[Total tonnage of Hong Kong, 1,806,881 tons.]		
Nagasaki and Hakodadi, Japan, 1865,	479	160,484
Labuan, 1863,	8	1,670
[Entered only.]		
Siam, Bangkok, 1865,	146	52,197
Philippine Islands, 1864,	No returns.	
Java and Madura, 1863,	555	358,880
Australia and New Zealand, 1863,	923	655,586
[Total tonnage, 3,834,772 tons.]		
	8929	5,088,165

The tonnage of China should be added to the above; but of the 16,684 British, European, and United States' vessels, with an aggregate tonnage of 6,458,515 tons, which entered and cleared from the ports of

China (exclusive of Hong Kong), in 1864, the statistics do not state what number sailed from and to Atlantic ports.

In 1854 the commerce between the United States and the Pacific (exclusive of California) amounted to 957,599 tons, in 1856 vessels; the value was 33,953,456 dollars.

In 1858, 1,000,000 of tons of freight were carried to Australia in American ships.

In 1863 the value of the imports into Australia was	£34,264,597
,, ,, exports ,, . .	28,378,355
Total, . .	£62,642,952

The export of bullion and specie included in the above amounted to £12,677,319.

The export of gold from Australia from 1851 to 1866 amounted to £140,000,000. This amount of gold would form a pyramid 50 feet 10 inches high, and 10 feet square at the base; its cubic measure would be 1994 feet, and it would represent a weight of 1071 tons 3 qrs. 12 lbs.

The population of Australia, in 1863, was 1,439,050.

FINANCE.

The profits that would be derived from the Canal would consist of the tolls on ships passing through it. If we add to the 5,088,165 tons, given above, 500,000 for places from which the returns are incomplete, and 2,500,000 for China, the total will be upwards of 8,000,000 of tons, which at 5*s.* per ton tollage, would yield a revenue of upwards of two millions sterling per annum. Besides this, a large income would be derived from the sale or rents of lots of land, which would be required for building on, as a "Magic City" would soon spring up at either terminus; and at a later period land would be in demand for tillage and grazing farms, for the revictualling of ships passing through.

The Canal once cut, the expense of its maintenance would be trifling.

It may be assumed that the profits of the Canal will pay an interest of 33 per cent. on £6,000,000, the probable cost; and this would be always increasing *pari passu* with the increase of the population and commerce of the world.

Doubtless the principal maritime nations will conjointly guarantee to the stockholders of any company that may undertake the construction of the Canal a sufficient rate of interest during the progress of the work.

Estimating the time that will elapse before the Canal can be opened, and before any revenue can be derived, at four years, and the cost at six millions sterling, and supposing that the Governments of England, France, Russia, and the United States should pay between them 5 per cent. on the stock issued, the following would be the sums to be advanced by each of them :—

				£
First issue of 1½ million, for	4 years,	..	.. ..	75,000
Second " "	3 "	..	.. ..	56,250
Third " "	2 "	..	.. ..	37,500
Fourth " "	1 "	..	.. ..	18,750
Total subscription from each nation,		..	..	187,500

At the audience which the deputation from the Atlantic and Pacific Junction Company had with the Emperor of the French in March, 1853, His Majesty declared his willingness to pay all the capital that would be required for the work over and above £6,000,000 sterling; and also to join England and America in guaranteeing 3 per cent. on the Canal, and 1 per cent. for a sinking fund.

A proposal was made by me several years ago to Lord Palmerston, the basis of which was, that the different Governments should cut the Canal at their joint expense, and then *throw it open to the shipping of the world free of tolls*: but the answer that I received was, that the work must be done by private enterprise.

The resources of each of the contributing states would be drawn upon very lightly to make up a total of six millions, which would be £500,000 each for England, France, Russia, and the United States; £400,000 each for Austria, Prussia, Italy, Spain, and Portugal; £150,000 each for nine other maritime nations of Europe; and £46,500 each for fourteen South and Central American maritime nations.

POLITICAL CONSIDERATIONS.

The Canal must not be under the control of any one of the great maritime powers. It must belong to the world, like the oceans which it will connect. It must be the world's highway, open to the commerce of every nation. The neutrality of the Isthmus must be guaranteed by all the powers, as well as that of the oceans to the distance of 1000 miles from each end of the Canal. The first point has already been agreed upon, and the principle of the second admitted, in the second article of the Bulwer and Clayton Treaty,* which runs thus:—"Vessels of Great Britain or the United States, traversing said Canal, shall, in case of war between the contracting parties, be exempted from blockade, detention, or capture by either of the belligerents; and this provision shall extend to such a distance from the two ends of said Canal as may hereafter be found expedient to establish."

The sovereignty of New Granada (now the United States of Colombia) over the Isthmus was guaranteed by the United States by the Treaty of December 12, 1846; and the former thereupon abolished the custom houses, and agreed to admit all foreign imports into the Isthmus free of duty.

---

* Signed at Washington, April 19, 1850; ratifications exchanged at Washington, July 4, 1850.

In conclusion—it is not too much to say, that this project is the great commercial, financial, scientific, moral, religious, and political problem of the age, which, when accomplished, will do more to civilize mankind than any other project. This cosmopolitan work, once completed, will endure for ages, a monument of man's enterprise, surpassing all others ever accomplished. In the words of the "Times"—"*It is the grandest physical work the world can witness.* The past has seen nothing like it, and any similar fame will be denied to the future, since there will be no more hemispheres to join." The "Sun" has said—"Ere long Darien will be the great interoceanic portal, the door of the seas, the *entrepôt* of the world, the storehouse of nations, the grand highway of commerce."

And its execution will confer upon mankind greater blessings than mere monetary ones. All the commercial nations of the world will join in guaranteeing the neutrality, not only of the territory through which it will pass, but also of the seas for 1000 miles or more from either terminus. The coasts will become common ground, where war shall not approach. This is the way towards securing universal peace. The Greeks had their games, so that they might meet on common ground once a year. The Isthmus of Darien will be common ground every day in every year, where all the nations of the earth will meet in peace.

Since the above was printed I received the following letter from B. B. Stoney, Esq., C. E., the Secretary of the Institution of Civil Engineers of Ireland :—

"*Ballast Office, North Wall, Dublin, Engineering Department,*
July 1, 1867.

"DEAR SIR,—In compliance with your report, I have made an approximate estimate of the cost of a ship canal from Caledonia Harbour to the mouth of the Lara—89 miles long, 90 feet wide, and 30 feet deep. The estimate is based on your section, in which you have marked two ridges crossing the proposed canal—one 180 feet, and the other 120 feet above the sea. If the canal were made with a summit level 90 feet over the sea, six locks would be required on each side, or twelve in all, of which two would be sea locks. This plan assumes that the rivers will supply the summit level with water enough for lockage during all seasons. The cost of the engineering works would be about £9,000,000, supposing the excavation to be in rock, and to cost 4*s*. per cubic yard.

"B. B. STONEY.

"*E. Cullen, M. D.*"

Although the estimate of the French engineers is considerably lower, and although the late William Dargan declared that he would execute the work for £6,000,000 sterling, I consider the approximate estimate of Mr. Stoney, who has had much experience as an hydraulic engineer, to be deserving of consideration. There can be no doubt, however, but that the employment of gunpowder, gun cotton, and the new and powerfully explosive agent, nitro-glycerine, will greatly reduce the cost of excavation.

XIII.—*An Apparatus for the Estimation of Carbonic Acid and the Valuation of Manganese Ores.* By Dr. J. EMERSON REYNOLDS, Keeper of the Minerals, Royal Dublin Society.

[Read May 20, 1867.]

THERE are two modes of estimating the amount of carbonic acid* in a given sample of any substance—one, by direct weighing of the gas, and the second, by difference. In the first process the carbonic acid is separated from its compounds by a stronger acid; and the evolved gas, after desiccation, is absorbed by caustic potash; the *increase* in weight of the latter then directly indicating the amount of carbonic acid in the quantity of substance taken for analysis. This is an extremely accurate method, but much too complicated in details for technical purposes; hence the plan of indirect estimation is that now usually employed by chemists in all ordinary investigations. This consists in the liberation of carbonic acid from its compounds by a stronger acid, as in the former process; but in this case the gas is thoroughly dried, and then allowed to escape into the atmosphere; the *loss* of weight thus occasioned indicating the amount of carbonic acid. The form of apparatus in which this decomposition is effected is of some practical importance, since it is not only necessary that the arrangement should be convenient in use, very light, and easily managed, but it must also afford means for the thorough desiccation of the escaping gas. Numerous as the forms of apparatus are which have been proposed for this purpose, I yet ventured some four years ago to add another to the list; and, having since modified it slightly, I am happy to have this opportunity of laying it before the Royal Dublin Society, and describing its construction and use.

In order to prepare the apparatus, take a very light flask, of three ounces' capacity, with a mouth at least one inch in diameter; fit to this a sound cork. Next take a small tube flask, two inches long, and three-fourths of an inch at its widest part, so that it may easily be passed into the interior of the flask; fit a small cork to this also. Through the cork of the large flask pass two fine glass tubes. One of these should be straight, and sufficiently long to reach nearly to the bottom of the vessel, but leaving only an inch or two projecting above the cork; this is simply to admit air into the flask, and is closed during an analysis. The second is short, and curved externally; it passes through the cork of the large flask, and also just through that of the little tube, so as to establish communication between the inside of the latter and the atmosphere when the tube is placed within the flask. A very fine quill tube is curved nearly in the form of a fishing hook, and the longer limb passed through the cork of the little tube-flask, and reaching to the bottom of the latter. It will be observed that the whole arrangement is carried by the cork of the large vessel.

---

* The term "carbonic acid" is here used instead of the correct name, "carbonic anhydride," since the former is more generally understood.

The principle on which the apparatus acts will be apparent from the description of its mode of use. The little inner tube is three-fourths filled with concentrated sulphuric acid, and its cork with tubes replaced. The carbonate to be analyzed is put with a little water in the outer vessel, the cork of which is then securely replaced, thereby carrying into the interior the little sulphuric acid drying tube. Having first placed a plug of wax over the free extremity of the long glass tube, the apparatus is wiped and weighed.

After the weight has been carefully ascertained, connect the end of the curved tube with a chloride of calcium bulb, and apply the lips to the open extremity of the latter; then force air gently into the apparatus; this, by pressing on the surface of the sulphuric acid, will send it out through the curved end of the quill tube. Some care is required in this part of the manipulation; as, if the drop of acid be allowed to fall immediately into the solution of the carbonate, too rapid evolution of gas would take place; but if the flask be so inclined that the drop may fall on the external curved surface of the little tube containing the sulphuric acid, the rate at which the gas is evolved is perfectly under control.

The moment the gas is liberated, it forces its way through the curved tube, and likewise through the sulphuric acid, in bubbling through which it is completely dried; this desirable object being facilitated by the way in which the bubble is given off from the end of the tube—as, having to strike against the conical bottom, it is thus made to present a larger surface to the sulphuric acid; the gas finally escapes through the wide tube into the atmosphere. The manipulation is thus continued, blowing over the acid *guttatim*, until the carbonate is completely decomposed. When this is effected, a small quantity of acid is blown over, and the apparatus placed on the sand bath, or in boiling water, until the temperature is sufficiently raised to expel all the gas held in solution by the liquid. The wax plug is now taken out of the piece of quill tubing carried by the cork of the flask, and suction applied to the wider tube, until the air ceases to taste acid. The apparatus is now allowed to cool, then wiped perfectly dry, and re-weighed; the loss in weight will indicate the amount of carbonic acid contained in ten grains of the sample under examination.

If it be desired to analyze the carbonate of a base which forms an insoluble salt with sulphuric acid, it is only necessary to replace the tube plugged with wax by a bulb tube containing nitric acid, held *in situ* by atmospheric pressure, the upper part being stopped with wax. When the plug is removed, the acid flows out, and decomposes the carbonate; the carbonic acid evolved has still to bubble through the sulphuric acid before escaping into the atmosphere. The remaining steps of the manipulation are precisely the same as in the former case. The apparatus, if well made, and the proportions be properly adjusted, need not weigh more than from five to six hundred grains; though I have an arrangement at present which, when charged with the carbonate, acid, and water, weighs only about 470 grains.

It is obvious that this apparatus can be used with the same facility in analyzing manganese ores—for instance, when the percentage of pure pyrolusite in a given sample of ore has to be determined, it is only necessary to place fifteen or twenty grains of the finely powdered ore* in the larger flask, together with three times its weight of oxalic acid. When the whole arrangement has been weighed, sulphuric acid is blown over, and the succeeding steps of the operation conducted as in the analysis of a carbonate. The calculations, of course, are made in accordance with the equation,

$$MnO_2 + C_2O_3 = MnO + 2CO_2.$$

XIV.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

THE AUTHORS.

Brady (Cheyne, Esq., M. R. I. A., ...). The History of the Hospital for Incurables. 8vo. *Dublin*, 1865

Brady (Cheyne, Esq., M. R. I. A., ...). The History of Steevens's Hospital.) 8vo. *Dublin*, 1865

Brady (W. Maziere, D. D., ...) The alleged Conversion of the Irish Bishops . . . . at the Accession of Queen Elizabeth . . . . disproved. Fourth Edition. . . . . 8vo. *London*, 1866

HUGH JAMES FENNELL.

Breval (John, Esq.). The History of the . . . . House of Nassau, ... Account of the Houses of Baux and Chalons . . . . Letters of King William, while Prince of Orange. 8vo. *Dublin*, 1734

Charlesworth (Charles). Index. Rentals of Estates sold in the Incumbered and Landed Estates Court, Ireland. . . . 1850 to 1864. 4to. MS.

THE AUTHORS.

Colomb (Commander P. H.), and Commander H. W. *Brent*, Royal Navy. The Law of Port Helm. . . . . Suggestions for its Abolition. . . . . Abstract of Cases. 8vo. *London*, 1866

Colomb (Commander P. H., R. N.). Collisions at Sea: . . . . . . the Case of the "Amazon" and the "Osprey." . . . . . . 8vo. *London*, 1867

---

* When a carbonate is present in an ore, of course it is necessary to expel the carbonic acid of the latter by treatment with an acid, prior to commencing the analysis with oxalic acid.

THE AUTHORS.

Deane (Thomas Newenham). New Courts of Justice. Report submitted with T. Newenham Deane's Design. folio. *London,* 1867

Deane (T. Newenham). New Courts of Justice. Design submitted by T. Newenham Deane. [13 *Photo-Lithographic Plates.*] folio. *London,* 1867

Eagar (Frederick John). A Genealogical History of the Eagar Family, and their Maternal Connexions in . . . . Kerry. 12mo. *Dublin,* 1861

A. M'NEALE, ESQ.

Emigration to Natal, ... Land Grants, ... the Colony and its Industries. 8vo. *London, s. a.*

Appendix. *London,* 1866

SCIENCE AND ART DEPARTMENT OF THE COMMITTEE OF COUNCIL ON EDUCATION.

Fowke (Captain F., R. E.). Tables of . . . . the Strength of British Colonial and other Woods exhibited at the International Exhibition, 1862 ; . . . . with his Report on similar Experiments in 1855. 8vo. *London,* 1867

FREDERICK JOHN EAGAR, Esq.

Genealogical Account of the Bagge Family in . . . . Waterford. 12mo. *Dublin,* 1860

THE AUTHOR.

Grimshaw (Thomas Wrigley, A. B., M. B., Ch. M. (Dub.) ; . . .), Sphymographic Observations on the Pulse of Typhus. 8vo. *Dublin,* 1867

HUGH JAMES FENNELL.

Historical Account of the late Troubles during the Wars of Paris. . . . . 8vo. *London,* 1866

THE COMMITTEE OF THE INTERNATIONAL HORTICULTURAL EXHIBITION AND BOTANICAL CONGRESS.

International Horticultural Exhibition, and Botanical Congress, held in London, ... 1866. Report of Proceedings. 8vo. *London*: [1866]

HOMMAGE DE L'AUTEUR.

Jonquières (M. E. de). Lettre à M. Chasles sur une question en litige. 4to. *Paris,* 1867

THE AUTHORS.

Litton (Edward Falconer, M. A., ...). Life or Death, the Destiny of the Soul in the Future State. 8vo. *London,* 1866

Madden (Thomas More, M. R. I. A., Licentiate of the . . . . College of Physicians in Ireland, ...). On Insanity, and the Criminal Responsibility of the Insane. . . . . 8vo. *Dublin,* 1866

THE AUTHORS.

Madden (Thomas More, M. R. I. A., ... &c.). The Rinderpest of the Present Time, and the Contagious Cattle Distempers of Former Ages. . . . . . . 12mo.
Reprinted from "The Medical Press" 1866

Mulock (T.). The Queen's Literary Tribute to the Memory of the Prince Consort. 8vo. *Stafford*, 1867

COLONEL HAY, per JOHN RIBTON GARSTIN.

Pacatus Orbis. The Settlement of Europe according to the Conjectures of a Politician Sixty Years ago. 8vo. *Edinburgh*, 1867

THE AUTHOR.

Pacini (Dott. Filipo . . . . di Firenze). Della Natura del Colera Asiatico, . . . Colera Europeo, e . . . . altri profluvj intestinali. . . . . 8vo. *Firenze*, 1866

REV. BEAVER H. BLACKER, M. A., BOOTERSTOWN.

Paget (Thomas Tertius, Esq.). A Letter to . . . . the Lord Lieutenant of Ireland, on the Judgment . . . . in the Case of Talbot *v*. Talbot. 8vo. *London*, 1856

REV. BEAVER H. BLACKER, M. A., BOOTERSTOWN.

Pizey (Rev. C. T., M. A., ... Camberwell . . . . . .). The Ministry of Second Causes.—A Sermon. . . . . . .
8vo. *London*, 1866

REV. BEAVER H. BLACKER, M. A., BOOTERSTOWN.

Pizey (Rev. C. T., M. A., ... Camberwell . . . .). Christ's Great Problem.—A Sermon. . . . . 8vo. *London*, 1866

HUGH JAMES FENNELL.

Regicides.—An . . . . Accompt of the . . . . Trial and . . . . of Twenty-nine Regicides, the Murtherers of His late Sacred Majesty . . . .: . . . . . . 4to. *London*, 1660

THE AUTHOR.

Researches on Solar Physics. By Warren *De La Rue*, Esq., Ph. D., F. R. S., F. R. A. S.; Balfour *Stewart*, Esq., M. A., F. R. S., Superintendent of the Kew Observatory; and Benjamin *Loewy*, Esq., Observer and Computer at the Kew Observatory. Second Series. . . . . . . Area Measurements of the Sun-spots observed by *Carrington* . . . . . . from 1850–1860, inclusive. Printed for Private Circulation. 4to. *London*, 1866

JOHN ST. BARBE, ESQ.

St. Barbe (Charles, Esq., F. S. A.). Records of the . . . . Borough of New Lymington, in the County of Southampton. . . . Printed for Private Circulation, ... 4to. [*London*], *s. a.*

THE AUTHOR.

Traill (George William, F. G. S. E., Edinburgh). An Elementary Treatise on Quartz and Opal; . . . . the . . . . . . Localities in which they occur. 4to. *Edinburgh*, 1857

THE PATHOLOGICAL SOCIETY OF LONDON.

Transactions of the Pathological Society of London. Volume Seventeenth. . . . . . . Session 1865–66. 8vo. *London*, 1866

THE ROYAL SOCIETY OF SCIENCES, AT UPSAL.

Transactions. Nova Acta Regiæ Societatis Upsaliensis. Seriei Tertiæ. Vol. VI. Fasciculus Prior. 4to. *Upsaliæ*, 1866

THE ATTORNEY-GENERAL OF VICTORIA (AUSTRALIA), BY A. W. CHOMLEY, ESQ., Secretary to the Law Department.

Victorian Statutes (*The*). In Four Volumes. Published by Authority. 4to. *Melbourne*, 1866

THE AUTHOR, BY FREDERICK MOORE, ESQ.

Watson (J. Forbes, M. A., M. D., F. R. A. S., &c. . . . . . .). The Textile Manufactures and the Costumes of the People of India. 4to. *London*, 1866

THE REV. JOHN HIFFERMAN, Newport, Tipperary.

Woodward (the Rev. Henry, A. M. . . . . ., Rector of Fethard). Essays, Thoughts, and Reflections, and Letters, with a Memoir by his son, Thomas *Woodward*, A. M., Dean of Down. Fifth Edition. . . . 8vo. *London* and *Cambridge*, 1864

Woodward (the Rev. Henry, A. M. . . . ., Rector of Fethard). The Shunamite. Edited by his son, Thomas *Woodward*, A. M., Dean of Down. Second Edition. 8vo. *London* and *Cambridge*, 1863

Woodward (the Rev. Henry, A. M. . . . ., Rector of Fethard . . . .). Sermons. Fifth Edition. 8vo. *London* and *Cambridge*, 1866

(Signed) EDW. RICHARDS PUREFOY COLLES,
Librarian.

August 31, 1867.

BOTANIC GARDEN.

CHARLES MOORE, *Director of the Botanical Gardens, Sydney, New South Wales* (now in Europe), *Hotel Britannique, Avenue Victoria, Place du Chatalet, Paris*:—Large Wardian Case, filled with rare Plants, and some new to European collections.

DITTO:—5 parcels of Australian Seeds.

DR. HOOKER, F. R. S., *Royal Gardens, Kew*:—Plant of Victoria Regia.

DITTO:—24 rare Plants, and fine specimen of *Welwitchia mirabilis*, for Botanical Museum.

DITTO.—23 rare Plants.

MR. REID, *Royal Botanic Garden, Regent's Park, London*:—Plants of *Cinchona calisaya*, and several kinds of Bulbs.

Mr. Ortgies, *Inspector, Botanic Garden, Zurich*:—192 parcels of Seeds, a portion of which were collected in Japan, and sent to Zurich by Dr. Regel, of the Botanic Garden, Petersburgh.

Ditto:—21 very valuable Plants, among which were the following:—*Antiaris toxicaria, Cephælis, Ipecacuanha, Myroxylan peruiferum*, &c.

Dr. Lawrenson, R. N., 41, *Grosvenor-square, Rathmines*:—A parcel of mixed Seeds, from China and Japan.

Ditto:—52 kinds of Seeds, from Japan.

Jolliffe Tufnell, Esq., M. R. D. S., *Lower Mount-street*:—14 kinds of Seeds and climbing Plants, such as Ipomœa and Convolvulus, from East Indies.

Miss Hamilton, *Greytown, Nicaragua, U. S.*—12 kinds of Seeds, from Nicaragua.

Ditto:—A box containing a number of mixed Seeds, and two living Plants.

Signor Todaro, *Botanic Garden, Palermo*:—232 kinds of Seeds.

Max Leichtlin, *Carlsruhe, Duchy of Baden*:—One parcel of Plants.

Messrs. Veitch, *Nurserymen, Royal Exotic Nursery, Chelsea*:—20 very valuable and rare Plants.

Messrs. Low, *Nurserymen, Upper Clapton, London*:—24 very valuable and rare Plants.

Mrs. Acton, *Westaston, Rathdrum*:—One parcel of Fern Seeds, from New Zealand.

Mr. Jackson, *Nurseryman, Kingston, Surrey*:—15 scarce and valuable Plants.

Mr. Bull, *Nurseryman, King's-road, Chelsea*:—11 kinds of Plants.

Mr. Tyerman, *Botanic Garden, Liverpool*:—Plants of Cactus, with living Cochineal Insects on them.

Mr. Louis Van Houtte, *Nurseryman, Ghent, Belgium*:—A valuable donation of young Palms, worth upwards of £40.

—— Hankey, Esq., *Belford Park, Leatherhead, Surrey*:—9 kinds of rare varieties of British Ferns.

Dr. Wilson, 29, *Baggot-street*:—Parcel of Seeds, from China.

R. Farmer, Esq., *The Hill, Hornsey, London*:—A number of rare hardy Bulbs.

Dr. C. T. Moore, *Stephen's-green*:—7 kinds of Indian Seeds.

The Rev. C. Reynolds, P. P., *Kildalkey, Co. Meath*:—One parcel of Seeds of variegated Kale.

Laurence Waldron, LL. D., Hon. Sec. Royal Dublin Society:—7 kinds of Kohl Rabi Seeds.

Dr. Reichenbach, *Botanic Garden, Hamburgh*:—79 parcels of Seeds.

Mr. Thompson, *Seed Merchant, Ipswich*:—7 kinds of Seeds of rare Plants.

The Government Botanic Garden Sydney, by order of the Director, Mr. CHARLES MOORE, now in England:—One large Wardian case, filled with *Cycadaceous* Plants, new or rare, and of considerable value.

(Signed) D. MOORE, *Director*.

June 5, 1867.

NATURAL HISTORY MUSEUM.

JOHN H. BLAND, ESQ., *White Abbey, Belfast*:—Sixteen specimens of Birds from the Banda Oriental, San Salvador.

RICHARD WILLIAMS, ESQ., 38, *Dame-street*:—A young Shieldrake, a young Ruddy Shieldrake, and a Sandwich Island Gosling.

REV. SAMUEL HAUGHTON, M. D., *Trinity College*:—Some specimens of Zeolites, from India.

MAJOR-GENERAL CUNYNGHAME, C. B., *Royal Barracks*:—Some Ethnological Specimens from China, Borneo, and America.

NATHANIEL CALLWELL, ESQ., *Fitzwilliam-place*:—The Head and Horns of a Cashmere Ibex.

SIR D. J. CORRIGAN, BART., M. D., *Merrion-square*:—A Crested Blenny (*Blennius palmicornis*), from Dalkey Sound.

THOMAS E. BEATTY, ESQ., M. D., 18, *Merrion-square*:—Specimens of a *Malthaea vespertilio*, West Indies.

WILLIAM DEMPSEY, ESQ., *Clonaslee, Maryborough, Queen's County*:—Some specimens of Syringopora and Lithodendron.

WILLIAM CORBET, ESQ., *Castle Connell, County Limerick*:—A Rufous-necked Weaver Bird, and a Black-headed Manakin.

DITTO:—Two Peregrine Falcons (*Falco peregrinus*), and a Red-shouldered Parrakeet.

DITTO.—A fine specimen of the Gyr Falcon (*Falco Islandicus*), and a Parrakeet.

MAJOR MANLY, 5, *Upper Gardiner-street*:—Thirty Assagais, from Natal, South Africa.

R. GARDNER, ESQ., *Yorton, Salop*:—A specimen of Ripple-marked Sandstone, from the Grinshill Hill, Shrewsbury.

COMMODORE SIR F. L. M'CLINTOCK, R. N., *Admiralty House, Port Royal, Jamaica*:—A specimen of the Hammer-headed Shark, from Jamaica.

DITTO.—2 Eels, from Jamaica.

DITTO.—8 Bottles and a Tin Case, containing various specimens of Crustacea, Fish, Snakes, &c., &c.

DITTO.—A Collection of Crustacea, two Eels, and a Bottle, containing some Viviparous Fish, from Jamaica. Among the Crustacea are *Leptopodia sagittaria, Cardisoma Guanhumi, Gecarcinus ruricola, Lupa sanguinolenta, Pericera cornuta*, &c.

ALEXANDER MACALISTER, ESQ., M. D., 11, *Gardiner's-place*:—Two Monkeys' Skeletons.

SIR THOMAS MILLS RIDDLE, BART., *Strontian, Fort William, N. B.*:—A Collection of Rocks and Minerals, from Strontian.

JOHN MOLLOY, ESQ., 2, *Great Denmark-street*:—Two Swans' Eggs, and four Centenine Eggs, laid by Cochin-China Hens.

COLONEL J. S. MONTGOMERY, 14th Bombay Native Infantry, *Bombay*:—The Head and Horns of a Gaur (*Bibos cavifrons*), from India.

MISS ELIZABETH BOND, *Naas, County of Kildare*:—A Piebald Hare.

RIGHT HON. THE EARL OF ENNISKILLEN, *Florence Court, Enniskillen*:—Some specimens of Fossil Insects, from the Oolite and Tertiary formations; and a portion of a Skeleton of the Basking Shark (*Selache maximus*).

ROBERT CALLWELL, ESQ., M. R. D. S., 25, *Herbert-place*:—A pair of Capercaile, Male and Female (*Tetrao urogallus*), from Norway.

SIR RICHARD GRIFFITH, BART., 2, *Fitzwilliam-place*:—A Fossil Leaf, from the brown coal deposit of Töplitz, Bohemia.

MRS. ROBERT SCOTT, care of ROBERT H. SCOTT, ESQ., M. A., *Meteorological Office*, 2, *Parliament-street, Westminster, London*:—Specimen of the Roe (*Capreolus dorcas*), from Scotland.

LORD MAURICE FITZGERALD, *Kilkea Castle, Athy*:—A Water Rail (*Rallus aquaticus*), shot at Carton.

FRANCIS BUCKLAND, ESQ., 80, *Fleet-street, E. C., London*:—Four Specimens of the Lemon Sole (*Solea pegusa*, Yarrell).

LUDOVIC STEWART, ESQ., Surgeon Major, 78th Regiment, *Bombay*:—A Collection of Fish, from the neighbourhood of Gibraltar.

T. F. BRADY, ESQ., Secretary to the Fisheries Commission:—Three Smolts, from the River Annan, in Scotland.

MRS. KIRBY, 33, *Waterloo-place*:—A valuable Collection of Insects of various Orders, from the neighbourhood of Poona, India.

CHARLES LANGLEY, ESQ., *Coolkennedy, Thurles*:—A Leporine, or hybrid between the Hare and the Rabbit.

ROBERT WARREN, ESQ., *Moyview, Ballina*:—A young Specimen of the Ca'ing Whale (*Globiocephalus Svineval*), found stranded at Enniscrone, Sligo.

R. D. HIME, ESQ., *Bengal Civil Service*:—Two Skulls and Horns of the Indian Buffalo (*Bubalus arna*); three Skulls and Horns of the Indian Antelope (*Antilope bezoartica*); two Heads and Horns of the Sambur Deer (*Rusa Aristotelis*); and some *Coleoptera*, from Brazil.

E. J. DAWSON, ESQ., *Houndswood, Cong*:—A fine Hooper, or Wild Swan (*Cygnus ferus*), shot near the village of Cross, Co. Mayo.

WILLIAM KANE, ESQ., 20, *North Great George's-street*:—A Crested Grebe (*Podiceps cristatus*), shot on the lake at Drumreashe, Monaghan, in July, 1866; a Sparrow Hawk (*Accipiter fringillarius*); a Purple Sandpiper, and a Ring Dotterell, stuffed.

Frederick J. Foot (the late), Esq., Geological Survey of Ireland (through J. Beete Jukes, Esq., Director of the Geological Survey of Ireland):—Two Lemmings (*Lemmus Norvegicus*), young and old, captured in Norway.

A. A. Dunlop, Esq., 95, *Baggot-street, Dublin*:—A Head of a Crocodile, from India.

Alexander Carte, M.D., F. L. S., *Director*.

May 1*st*, 1867.

INTELLIGENCE.

SCHOOL OF ART, ROYAL DUBLIN SOCIETY.

The Annual Distribution of Art Prizes took place on Friday, December 22, 1866.

The Hon. George Handcock, Vice-President, in the Chair.

Mr. J. Shaw Smith introduced the subject of the meeting, and called upon the Assistant Secretary to read the Report of the School for the year 1865–66, prepared by Lieut-Colonel Adamson, the Chairman of the Fine Arts Committee.

Dr. Steele, Assistant Secretary, then read the following

REPORT OF THE CHAIRMAN OF THE FINE ARTS COMMITTEE FOR THE YEAR 1866.

In submitting the Report for the year 1866, it is with great satisfaction that I have to state that the operations of the School of Art of the Royal Dublin Society have, during the past year, been conducted with the greatest success, and at no period since its establishment has its progress been so marked. The zeal of the Students has been such that they have industriously, cordially, and heartily seconded the efforts of their instructors, and the result has been productions in the various departments of study, which for number, variety, and finish, prove that the progressive efforts of the superintendents of their labours have not been in vain.

The attendance of Students during the year has been as follows:—

Males.	Females.	Total.
226	205	431

The number attending the Artisan Classes has been 203, of which 190 were males, and 13 females.

Amongst these Artisan Students were—twenty-four clerks, fifteen teachers, nine lithographers, eight housepainters, seven carpenters, six builders, nine salesmen, five artists, five upholsterers, three stucco plasterers, three enginefitters, four architects' apprentices, three draughtsmen, three engineers, two printers, two cabinet makers, two coach painters, two leather dressers, two shipwrights, three stone carvers, and two bricklayers.

The greatest attendance was in March, and the smallest in July. The fees have amounted to £418 1*s.* 4*d.* The number of pupils instructed in Elementary Drawing in Public and other Schools by teachers educated in the Central School has been 2354. The examination of these Schools took place in May: of the pupils who presented themselves, 635 passed "Fair;" 847 "Good;" 345 "Excellent."

The Annual Examination of the School of Art took place on the evenings of the 12th, 13th, and 14th days of March. The papers were forwarded by the Department of Science and Art, and were returned immediately after the Examination to South Kensington Museum for inspection. Many well-qualified Students were prevented from presenting themselves in consequence of the Examination being fixed by the Department to take place in the evening.

Of 119 Students, fifty-two were successful in passing in eighty papers, consisting of Practical Geometry, Freehand Drawing, Perspective, Model Drawing, and Projection. One hour was allowed for each exercise.

The following Gentlemen, Members of the Council and Fine Arts Committee, conducted the Examination:—Lieut. Col. Adamson; Walter Lindesay, Esq., J. P.; Edward W. Seymour, Esq.; William M'Kay, Esq., LL. D.; Joseph Kirk, Esq., R. H. A.; John Shaw Smith, Esq.; Henry T. Vickers, Esq.; and Sir Robert Harty, Bart.

Full Certificates for passing in four of the subjects mentioned above, and Prizes and Certificate Cards for Excellence or Proficiency in one, were awarded to successful Students by the Department. William Millard, and Thomas Lalor Hayes, deserve special mention, having passed in the whole of the papers required in order to obtain the full Certificate; the former Student passed at the mark "Excellent" in three of the exercises, the latter in two.

The works in Drawing, Painting, and Modelling, were forwarded to London in March, to compete with similar works of all the Schools for Medals and Prizes.

Under a regulation in force from 1857 to 1865, when a course of twenty-three stages of instruction was prescribed to Schools of Art, and works of the imperial size were insisted upon, Local Medals were awarded to the most meritorious; from works so distinguished, the best were selected for National Competition for Medallions, which were limited to 100 for all the Schools; the number of Local Medals that could be awarded to any one School was limited to thirty; very few Schools, however, reached the maximum, although last year this institution carried off thirty-two by reason of the high excellence of its productions.

According to the new regulations consequent upon the recommendation of the Parliamentary Committee on Schools of Art in 1864, Local Medals are abolished, and eighty National Medals were offered to be competed for by the 112 Schools of Art now in operation in the United Kingdom.

The total number of works sent from the Society's School was 113, consisting of Studies in most of the stages of instruction. Fourteen Prizes, and eight Honourable Mentions were awarded; the great number of forty-one works were selected to compete for the National Medals, seven of which were gained as follows:—

Silver.	Model in Clay, ...	Joseph Watkins.
Do.	Applied Design, ...	William H. Murray.
Bronze.	Group in Oil Colours, ...	Mrs. Robert Seymour.
Do.	Painting of Still Life in Oil Colours, .	Mrs. Elizabeth Smith.
Do.	Anatomical Study in Sepia, ...	Miss Kate Seymour.
Do.	Landscape painted from Nature, in Oil Colours, ...	Francis Walker.
Do.	Flowers painted from Nature, in Water Colours, ...	Miss Frances Seymour.

A Queen's Prize was also awarded to Mrs. Elizabeth Smith, for a very admirable set of Anatomical Studies in Water Colours. Of the 112 Schools of Art, thirty-one were successful in the Medal Competition, and Dublin is the only School in Ireland to which such awards have been made; one-tenth of the Silver, and the same proportion of the Bronze Medals, having been won by the Students of this institution; our School is in this respect only surpassed by London and Manchester.

The Examiners were—Sir F. Grant, P. R. A.; Daniel Maclise, R. A.; J. C. Horsley, R. A.; Frederick Leighton, A. R. A.; Richard Redgrave, R. A.; and H. A. Bowler, Esq.

There can be no doubt of the extreme value of the National Competition as showing the best productions of the Schools in juxtaposition, and enabling us to arrive at more just conclusions with regard to the merits of particular schools and methods of instruction.

Two of our Students have distinguished themselves in the competition for the Taylor Prizes.

The adjudication of the Medals offered by the Royal Dublin Society took place on the 18th instant: Sir George Hodson, Bart.; Lieutenant-General Colomb; and Thomas A. Jones, R. H. A., acting as Judges.

Works were submitted and Medals awarded in the following subjects:—

1st Silver.	Painting from the Life. (Seven Works.)
1st Silver.	Drawing of full-length figure from Antique, shaded in Chalk. (Eight Works.)
2nd Silver.	Drawing of Head, Hand, and Foot, from Antique, in Chalk. (Seven Works.)
2nd Silver.	Anatomical Studies. (Four Works.)
1st Silver.	Landscape, painted from Nature. (Twenty-five Works.)
2nd Silver.	Modelling in Clay, from the Life, or Antique. (Eleven Works.)
1st Silver.	Design for Manufactures. (Twenty-five Designs.)
1st. Silver.	Architectural Drawings from actual measurement. (Six Works.)

Four Bronze Medals in the following subjects, viz.:—

Geometrical Drawings. (Six Works.)
Perspective Drawings. (Two Works.)
Models shaded in Chalk, from the Round. (Eight Works.)
Orthographic Projection. (One Work.)

The Examiners recommended the following additional Medals:—

Drawing from the Antique,	2 Bronze, 1st.
Anatomical Drawing,	1 Silver, 2nd.
Modelling from Antique,	1 Bronze, 1st.
Original Design for Manufactures,	1 Silver, 2nd.
Do. do.	3 Bronze, 1st.
Model Drawing,	1 Bronze, 1st.

The names of Students successful at the March Examinations of the School, Competition of Drawings in London, Competition for Society's Medals, and Taylor Prizes, will be found in the Programme of Distribution.

During the past year Design has received an increased degree of attention, and there is evidence of a greater desire on the part of Manufacturers to make available the excellent designs produced in our School. Four designs for figured Terry, by Mr. Henry Felix Thomas, and one by Miss A. F. Ruxton, are now in progress of manufacture by Messrs. Fry and Co., Westmoreland-street.

It is to be regretted that so many Students and others should neglect the consideration of this branch of Art, at once so important, interesting, and remunerative, and which may truly be termed æsthetic, in which beauty and taste have to be united with practicability, requiring imagination and artistic power of a high order. In the designs of Raffaelle, Cellini, Durer, Giotto, and Holbein, we see, combined with inventive genius, those workmanlike powers of execution, the result of long practice and intelligent study:—we would do well to imitate those great men in this respect: a complete power of handling is the only guarantee of future excellence, essential for the true representation of objects, and the just expression of ideas; and all alike should aim at the acquisition of this indispensable quality, necessary in every department of Art, whether in a design for Manufacture, or in that which has for its object the poetical, the imaginative, or the historical. There is really no difference between a School of Design for Manufactures and an Academy of Fine Arts as' to the kind of instruction that should be afforded, only in the degree to which it should be carried—true instruction should have regard to Art in all its relations.

The Schools of the Society combine the functions and fulfil the conditions of both; and the degree to which instruction in the higher branches is carried in this institution renders it suitable for those who purpose devoting their attention to Fine Art. The varied character of the studies pursued in this School recommends it as affording the most complete Art Education that can be obtained in Ireland.

An Exhibition of the works of the Students will be on view daily in the School of Art, for the next fortnight, from 10 to 3 o'Clock, and will be free to the Public.

(Signed) S. H. ADAMSON, Lieut.-Colonel,
December 19, 1866. *Chairman.*

The Assistant Secretary then read the following Report of the Judges of the Works executed in competition for the Prizes offered by the Society for 1866:—

REPORT.

IN making our adjudication of the Premiums for works submitted for competition in the Schools of Art in 1866, we have great satisfaction in observing the very great advance which has been made during the past year by the Students in these Schools, not only in the higher branches of study from Nature and the Antique, but in the equally important departments that have for their object the promotion of Art as connected with Manufactures.

We especially wish to record our approbation of the admirable examples exhibited by the Pupil Teachers in Drawings from the Antique, evincing considerable skill and proficiency; and we have also been most favourably impressed with the great beauty and suitable character of the Designs for Printed Muslins, Carpets, Room Papers, and Poplins, many of them bearing testimony to patient and attentive study of the rules by which successful results from colour and composition are obtained.

The following are the awards made by us in the several Departments of the List submitted:—

1. For the best Painting of a Head or full-length Draped Figure; size of the former, 24 inches × 20 inches; of the latter, 29½ inches × 21½ inches, First Silver Medal—
Miss Frances Seymour; with Honourable Mention of the work of Miss Clara Bayly.

2. For the best Drawing, shaded in Chalk, of an Antique Figure, not less than 2 feet high, First Silver Medal—
Miss Elizabeth Smith. A First Class Bronze Medal recommended in the case of Miss Lizzie Langan.

3. For the best Drawing, shaded in Chalk, of a Head, Hand, and Foot, from the Antique, size of Nature, Second Silver Medal—
Stephen Catterson Smith. With a Bronze Medal to Miss Charlotte Benson.

4. For the best set of Anatomical Drawings, Second Silver Medal—
Miss Elizabeth Smith. Second Silver Medal to Miss Lizzie Langan; and Honourable Mention of the Drawing by Miss Elizabeth Irwin.

5. For the best Landscape of Irish Scenery, painted in Oil or Water Colours, from Nature, First Silver Medal—
James Alfred Aitkin. Bronze Medal to Michael Fitzgerald. With Honourable Mention of the Sketches in Water Colours by William Henry Murray.

6. For the best Model in Clay, from the Life, or of an Antique Figure, in low relief, 2 feet high; or of an Antique Bust, Second Silver Medal—
Miss Kate Seymour. We regret that the rules for our guidance preclude us from noticing the works of Mr. Joseph Watkins except by Honourable Mention.

We recommend a Bronze Medal to Mr. William Millard for his study of the Head of Laocoon.

7. For the best Design, or set of Designs, for Manufactures, First Silver Medal—
Miss Anne Ruxton. Second Silver Medal to Miss Frances Seymour; and a Bronze Medal each for the Designs by Miss Harriet Everth, Miss Clara Bayly, Miss Matilda Booth.

8. For the best Drawing, made from measurement, of a Public Building in Dublin; size, 29½ in. × 21½ in., First Silver Medal.
Mr. Henry Edward Hall.

A Bronze Medal was given in each of the following Subjects.

9. For the best sheet, Imperial size, of Geometrical Drawings, Mr. Alexander Robinson.
10. do., do., Perspective Drawings, Miss Lucy Hamilton.
11. do., do., Models shaded in Chalk, Mr. John W. Kennedy. (With a Bronze Medal to Mr. Joseph M'Donnell.)
12. do., do., Orthographic Projection. No competition.

In closing our Report, and in again expressing our approval of the marked progress made in recent years by the Students of the Schools of Art, we are desirous of expressing our opinion that such satisfactory results are mainly to be attributed to the zeal, energy, and ability displayed by the Head Master, Edwin Lyne, Esq., in the various Departments of which he has charge.

(Signed) George Hodson, Bart.
George Colomb, Major-General.
Thos. A. Jones, R. H. A.

Dublin, *December* 19, 1866.

The Students named in the Report were each presented to the Vice-President, who delivered the Prizes to the Students named in the Report.

The Prizes awarded by the Science and Art Department were next delivered by the Vice-President, in the following order:—

PRIZES AWARDED BY THE DEPARTMENT OF SCIENCE AND ART.

National Silver Medals.—William H. Murray, Applied Design; Joseph Watkins, Modelling in Clay from the Life.

National Bronze Medals.—Georgina A. Birch, Group in Colours; Frances Seymour, Painting Flowers from Nature; Kate Seymour, Anatomical Studies; Elizabeth Smith, Group in Colours; Frances Walker, Painting Landscape from Nature.

Queen's Prize.

Elizabeth Smith, for Anatomical Studies.

National Prizes.

Mary C. Lawlor, for freehand outline of ornament from the flat; Jane E. Sharpley, for do.; Matthias Pigott, for do.; James Kearney, for shading of ornament from the flat; Margaret Kennedy, for freehand outline of the human figure from the flat; Zoë Ilberry, for do.; Ellie Monsarratt, for do.; Marcella Irwin, for freehand outline of ornament from the round; Roderick O'Farrell, for shading in chalk of models from the round; William Millard, for do.; Henry F. Thomas, for shading in chalk from the human figure, after Mulready; Anthony Bassiere, for architectural design; John Vantright, for do.; Henry Edward Hall, machine drawing.

Honourable Mention.—Elizabeth J. Bredin, in freehand outline of ornament from the round; Mary A. Bredin, do.; Elizabeth Irwin, do.; Ruth Nicholson, in shading in chalk of ornament from the flat; John William Kennedy, in shading in chalk of models from the round; Robert Walsh, do.; Robert Walsh, in freehand outline of the human figure from the flat; Kate Ferguson, do.; James Boyle, do.

Selections for National Competition.—James Kearney, shading of ornament from the flat; Mary K. Benson, freehand outline of the human figure from the round; Henry F. Thomas, shading in chalk of the human figure from the flat; Francis Walker, shading in chalk of the human figure from the round; Susan E. Davis, do.; Kate Seymour, anatomical studies of the human figure; Elizabeth Smith, do.; Alice Metze, painting of ornament in monochrome from the cast; Diana Sullivan, painting of flowers in water colour from copies; Mary K. Benson, painting of flowers in water colours from nature; Frances Seymour, do.; Francis Walker, painting of landscape in oil from nature; Edmund Byrne, do.; Mary K. Benson, do.; Georgina A.

Birch, painting groups in oil as compositions of colour; Elizabeth Smith, do.; Anna F. Ruxton, do.; Kate Seymour, painting the human figure in monochrome from the cast; Kate Seymour, painting the human figure in oil from nature; Anna F. Ruxton, do.; Joseph Watkins, modelling the human figure from nature; Matilda Booth, original design of ornament in water colours; Clara Rudkin, historic styles of ornament; Milian C. Purcell, do.; Henry Edward Hall, design of machines; Marcella Irwin, applied surface design; Henrietta Hamilton, do.; William H. Murray, do.; Minnie Mahony, do.; Robert Mitchell, do.; Roderick O'Farrell, do.; Harriet M. Everth, do.; Anna F. Ruxton, do.; Margaret Gray, do.; Frances Seymour, do.

Full Certificates (*Second Grade*).—Mary A. Bredin, Thomas L. Hayes, Mary Kealy, John W. Kennedy, William Millard, Margaret Kennedy, Delia Ryan, Kate Seymour, Eliza E. Bredin.

Second Grade Prizes.—Anne J. Banks, for geometry; Charlotte E. Benson, for freehand; Lucius H. Deering, for freehand; Michael Fitzgerald, for freehand; Isabella C. Bergin, for perspective; Peter Browne, for geometry; Kathleen Elwood, for perspective; Conway Ferguson, for geometry; Sharland Hanly, for model; Margaret Hart, for freehand; Thomas L. Hayes, for geometry and perspective; Margaret Kennedy, for model; William Millard, for freehand, geometry, and model; Alexander Robinson, for perspective; Katie Rutton, for perspective; George J. Sanders, for freehand; Kate Seymour, for mechanical; John S. Smith, for geometry; Stephen C. Smith, for freehand; Barbara G. Stoney, for geometry; Thomas Stringer, for geometry and model; John Vantright, for freehand; Arthur Webb, for freehand.

Second Grade Certificates.—Annie J. Banks, for freehand and model; James F. Boyle, for freehand and model; Elizabeth F. Bredin, for freehand and model; Mary A. Bredin, for freehand; Elizabeth M. Brett, for model; Kathleen Elwood, for model; Kate Sophia Ferguson, for freehand; Michael Fitzgerald, for model; James William Ford, for geometry and model; Sarah J. Gregg, for geometry; Jane Hamill, for freehand; Sarah J. Hanly, for geometry; Sharland Hanly, for geometry; Margaret Hart, for geometry and model; Thomas L. Hayes, for freehand and model; Patrick J. Higgins, for geometry; Zoë Ilberry, for freehand; John S. Keaghey, for freehand; Mary Kealy, for mechanical; James Kearney, for freehand; John William Kennedy, for freehand, geometry, and model; Margaret Kennedy, for perspective; Charlotte Kenny, for freehand; Madeline M'Dermott, for freehand; Joseph M'Donnell, for perspective; Joseph M'Manus, for freehand; William Millard, for perspective; Ruth Nicholson, for freehand and perspective; Henry B. L. Overend, for geometry; Alexander Robinson, for mechanical; Katie Rutton, for geometry; Delia Ryan, for geometry and perspective; Charlotte Shaw, for geometry; Frances M. Smith, for geometry; Stephen C. Smith, for model; Barbara G. Stoney, for model; Thomas Stringer, for freehand; John Vantright, for model; James Mayne, for geometry.

(Signed) EDWIN LYNE, *Head Master.*

REPORT OF THE JUDGES OF TAYLOR PRIZES FOR 1866.

In our consideration of the Works submitted to us, on the occasion of the Distribution of Taylor Prizes for 1866, we have remarked with much concern an almost total absence of competition, which the importance of the inducements offered might reasonably have been expected to call forth.

In the First and Second Class of these Premiums, viz., for Figures in Outline, and Finished Drawings from the Nude, we are reluctantly obliged to withhold the Prizes offered by the Trustees—the Works submitted being few in number, and deficient in those indispensable requirements which an attentive study of nature and of the examples that remain to us of ancient Art are calculated to supply.

In Class No. 3, a study in oils of Landscape Scenery, comprising wood and water, by Francis Walker, we have observed considerable attention to detail, combined with judicious observance of general effects; and we recommend, in this case, that the sum of £10 offered be supplemented by the additional sum of £5.

There is much ability displayed in the Water-coloured Drawings by Miss Anne F. Ruxton; and we regret we are unable to award a Prize to her, in consequence of the requirements as to size not having been complied with.

Mr. Joseph Watkins has exhibited, in various stages of completion, several Models in clay and plaster from the Life, which evince much skill in manipulation, and a facility in rendering resemblance. We are unanimously of opinion that the Trustees might judiciously exercise their powers in furtherance of the Testator's intentions, by awarding to this student a Scholarship of £30 for two years, provided the funds at their disposal will admit of their so doing, and that a work be produced in each year by Mr. Watkins, of such merit as may indicate that he has thereby been enabled to devote a portion of his time to the study of Drawing, Anatomy, and Composition, so essential to successful progress.

George Hodson, Bart.
Thomas Alfred Jones, R. H. A.
Catterson Smith.

The Trustees have decided upon awarding a Scholarship of £20 to Mr. Joseph Watkins, subject to the conditions of Rule 3; and a Prize of £15 to Mr. Francis Walker, in addition to the renewal of the Scholarship which was awarded to him last year.

When the Prizes had been distributed, the Vice-President addressed the meeting as follows:—

Ladies and Gentlemen,—I have now, in the first instance, to express the regret I feel, in common with every one whom I now address, at our not having been honoured with the presence of His Excellency the Lord Lieutenant on this occasion. We, of course, have invited His Excellency, as President of the Society, to come here to-day, and give away the Prizes; but, unfortunately, he was so engaged that it was out of his power to preside, and he could not come. Had His Excellency been here, I am sure he would have felt great gratification at this interesting ceremony we have now gone through. I merely occupy this Chair as one of your Vice-Presidents; and I shall not occupy your time very long, for the Report which has just been read is very comprehensive, and goes into all the details of the various matters connected with this valuable School. It is gratifying to the Members of the Royal Dublin Society that the School is rapidly increasing, and that it is increasing in popularity, and I hope in inducements. The number in attendance this Session, commencing in October, is very great indeed, and all the Pupils have been exceedingly attentive to the gentleman who presides over them and to his assistants. On a former occasion His Excellency the Earl of Kimberley, when he occupied this Chair, expressed some regret that the artisan class of this city did not attend more largely a school in which they would derive so much benefit. We have not that to complain of now, as the artisan class of the students has increased very considerably indeed. In order not to interfere with the business of that particular class, most of whom are occupied all day, the Society has the School lighted up at night; so that they can go to the School in the evening, and derive the benefits that we are most desirous they should derive from the teaching of the School. It is gratifying to know that two of the Students—Mr. Atkin and Mr. Fitzgerald—in the artisan class, took the only Prizes offered by the Society in Landscape from Nature this year; and the first Prize for Architectural Drawing was also taken by one of the artisan class. I think that shows that the effect of the observations His Excellency the Earl of Kimberley thought proper to make is now beginning to tell, and that the artisans are beginning to find the value of our School. It was also alluded to on a former occasion that the fair portion of the students greatly outnumbered the gentlemen. On the present occasion we have not that fault to find either, if it be a fault; for I find, on looking over the numbers, that the gentlemen now are equal to if not in excess of the ladies, and I am sorry to say that they are taking away more Prizes than the ladies. Now, this exactly reverses the order of things; for formerly the ladies took away more Prizes; but the tables have been turned, and the gentlemen now outnumber the ladies in Prizes. I hope this is the last time any person who occupies this Chair will have an opportunity to make such a comment, and that the ladies will exert themselves, and not allow themselves to be outstripped by the gentlemen. Designing is now upon the increase, and some designs of the School are at this moment in process of manufacture; and the Society have deemed it useful to send circulars around to all the manufacturers in Ireland, informing them of the designs that are to be seen in the School, and of course asking them for their co-operation; I have no doubt it will have a beneficial effect; and we all know that taste has now improved to such an extent, and we are all getting so very fastidious, that it is necessary that every attention should be paid to bringing out that which is most beautiful and most attractive to the eye. In fact, if I may use the expression, we are rather spoiled now; for what our fathers and grandfathers would be satisfied with before I do not think any one in this room would be satisfied with now; or, as a friend of mine observed to me, "If we had the old willow-pattern plate put down to us for dinner now, not one of us would look at it"—so fastidious have we got in our taste—and I am glad of it. The first impulse given to this advance in Art was by the late Prince Consort, who did so much to promote and encourage the interest of Art. It was he also who promoted the Great Exhibition held in London, which had such a beneficial effect on Art, not only in England, but also on the Continent. That Exhibition was soon followed by others, which tended in the same direction; and we had an Exhibition of our own, at which creditable art specimens from our country were produced. We will have an Exhibition, which I hope we will be all at, in Paris, shortly; and I hope this country will contribute work that will stand in competition with other countries at that magnificent Exhibition, which is now in progress, and will probably be opened in May or June next. I do not believe that there is any other matter for me to lay immediately before you. You all know that we like to look at that which is beautiful and perfect; and the more the taste is cultivated, the more we desire to look at that which is beautiful and cultivated. Among the works of our students there are some which it would be really worth any of your while to examine. There are Models here from the Antique which are really worth studying. The School will be opened, as you heard detailed in the Report, during the Christmas holidays, and it would be well worthy of a visit to any one who could spare time to go there. Some of the Models are beautiful; and one, a head, done by the young lady I lately complimented, that is really most beautiful, highly creditable, and skilfully executed. I will not now detain you longer, but thank you for the kindness with which you have heard me.

The proceedings then terminated.

SPRING CATTLE SHOW.—MEETING FOR THE ANNOUNCEMENT OF PRIZES AWARDED.

THE meeting for announcing the Prizes awarded took place on Wednesday evening, April 24th, in the Lecture Theatre.

His Excellency the Marquis of ABERCORN arrived a few minutes after nine o'clock, accompanied by Viscount Hamilton, Lord James Butler, Dr. Hatchell, the Hon. Jenico Preston, the Hon. Gerald Dillon, and Mr. Gustavus Lambert.

Lord Naas, Chief Secretary, was also present.

His Excellency was received by the Right Hon. the Earl of Clancarty, the Rev. the Provost of Trinity College, and the Hon. George Handcock, Vice-Presidents; Lord Clonbrock; Mr. Maunsell, and Mr. Waldron, Secretaries; several Members of the Council, and the Committee of Agriculture.

His Excellency having taken the Chair,

Mr. G. W. MAUNSELL rose, and, after a few preliminary observations, said it might not be inappropriate to notice the new era which had commenced with the present year in respect to the affairs of the Royal Dublin Society. For a very long period of years the Society had enjoyed, by the liberality of Parliament, certain aids to the progress and advancement of agriculture; but those who regulated the destinies of the country had seen fit to withdraw that aid. That Society, he might say, presented a mixed body, in which science, art, and literature had been associated with agriculture. With regard to the several departments of the Society, exclusive of agriculture, the hand of Parliament was still liberally extended: but, for reasons of political economy, which it did not become him to question, they thought fit to withdraw the aid which had hitherto been granted to them. They now came before the agriculturists of Ireland, standing altogether upon such support as they might be able to gather from them in support of the Society. And no more pleasing duty could devolve upon himself, or upon his colleague, Mr. Waldron, than that of taking charge of the admission to this distinguished Society of those gentlemen who, being associated with the prosperity of Ireland, were willing to be enrolled as members, and to co-operate with them in their honourable task. Another feature connected with the Show of the present year was, that they had two new officers occupying positions which heretofore had been filled by old and tried friends of the Society. He might first allude to Dr. Collins, who for five-and-twenty years filled with credit to the Society, and honour to himself, the position of Chairman of the Agricultural Committee. Increasing years inclined Dr. Collins to withdraw from the more active sphere of exertions; but they trusted they would long have the benefit of his experience and wisdom to guide them in the conduct of their affairs. It was only due to Dr. Collins to state, that during his presidency of the Committee the number of entries in their Shows had increased from 25 till they reached 250, while the renown of their Shows had raised this Society to the highest pinnacle, as the pioneers and leaders of agricultural progress in Ireland. But they had likewise another officer to regret the loss of, in the person of Lord Dunlo. For reasons which it was unnecessary for him to enter into, but chiefly connected with His Lordship's residence in the West, he had found it necessary to withdraw from the more active service of the Society as its Honorary Secretary. Those who knew how Lord Dunlo had exerted himself, and the efforts he made to obtain from the authorities in the sister kingdom recognition for the agricultural department of the Society, and more especially recognition of the veterinary department, could not but feel that the loss of His Lordship's services would be long and seriously felt by those who took part in the working of the Society. But, while they parted with old friends with regret, they welcomed their successors with confidence and hope. The Committee had placed in the presidential chair of the agricultural department one whose family had long been connected with the agricultural progress of the country—Robert Craven Wade, of Clonabreny—whose intelligence and high character had won the respect of Irishmen of all classes. And with not less felicity of selection they had done him the honour to associate with him as colleague Mr. Waldron—a gentleman whose antecedents as a public man, not more than his position in private life, and his experience in conduct of public business, had marked him, in their unanimous selection, as the right man in the right place.

Turning from our more immediate affairs, he would venture some remarks upon the present Show. And first, he might observe upon what was the value contained in all such shows.

Eighty years ago Arthur Young had laid down, that improvements in agriculture must originate with landlords. If that were true eighty years ago, how much more true at the present time, when science enters into every department of farming, and chemistry is linked with practical agriculture! It is in these Shows, he might say, that we "take stock" of agricultural progress. Here we learn how permanent excellence in stock can only be secured by purity of blood, and what are the characteristics of each species of stock, when pushed to their highest point of improvement. Here we learn the chemistry of foods, and of manures—the constituent elements of each—the new adjustments from time to time required in agricultural industry; how one improvement follows and lean, upon another—drainage, green grops, artificial food, and artificial manures; how high-bred stock involves mixed husbandry, varied crops, improved wages, and cheerful homes for our agricultural labourers.

It is curious to observe what a change has come over the spirit of agricultural meetings within the past fifty or sixty years. Time was when cereals, grain of all kinds, its varieties, and its culture, formed the staple of agricultural meetings or writings. He had already quoted the observation of Arthur Young; and never was its truth more verified than in the vigour and earnestness with which our great houses threw themselves into the movement, under which live stock has taken the place of corn. Woburn, Petworth, and Holkam, are illustrations of that energy. It is long since the foundations were laid of the fame of those herds and flocks, whose reputations are now household words in the agricultural history of the period. But yoked with these

Paladins there was not less active the enterprise, the skill, and the practical sagacity of the Bakewells, Booths, Bates, Collinges; in later days, of Jonas Webb, of Fisher, Hobbs, and a score of others, whom it seems almost treason to omit. Scarcely a beast in our yard to-day who does not trace his descent from some Godolphin Arabian of the splendid herds of the sister country, chiefly Booths, and Bates, showing, as he had already said, how permanent excellence and purity of blood are inseparably connected, giving that increased value to the stock of this country which our farmers are not slow to appreciate.

But scarcely less important than horned stock is the improvement which has been extended to sheep. The present is not the season for a Sheep Show; nevertheless, the yard to-day contains specimens of the various races, each of the highest order of merit.

The Leicester, the Long Wool, the South Downs, and Shropshire Downs, are all honourably represented; and a new species has recently been added to our Shows—he meant the Border Leicester.

Each has its advocate, as each has its merit. In sheep, perhaps more than in horned stock, climate, soil, and feeding must enter largely into consideration. The improved Lincoln, from which the flocks in the West of Ireland are largely descended, may best suit a market where aged sheep are the chief object. Our old favourite Leicesters, and our scarcely less celebrated Downs, may better serve the lamb markets of Leinster; while the advocates of Lord Polwarth's breed—the Border Leicesters—contend that the latter carry with them qualities suited to the climate of Ireland superior to any of the races hitherto introduced. *Tros, Tyriusve*—the Royal Dublin Society welcomes them all, and will continue to note their progress with careful impartiality.

Not less important to the prosperity of Ireland than its Cattle and Sheep, are its aces of Pigs. The Showyard this day gives ample evidence of progress in this department, and illustrates the different classes of swine in their highest perfection.

He had recently met with in, he thought, "The Farmer's Magazine," an anecdote of the late lamented Mr. Fisher Hobbs, in regard to rearing of pigs. Many years ago the late Lord Western had been struck by the appearance of the Neapolitan pigs; he brought home some of the choicest he could get, and crossed them with Essex; the cross failed, especially in the females, from weakness of digestive functions. Here the practical sagacity of Mr. Fisher Hobbs was called to aid: he at once saw the cause of the infirmity; he introduced a broad-chested Berkshire into the cross; and after a number of experiments he produced a race which, for smallness of bone, aptitude to fatten, and early maturity, have now no superiors in the United Kingdom.

He regretted the absence of poultry from the present show. When it was known that England now imported about one million of eggs per day all the year round, it might be judged how important it was to encourage our poultry; he was consoled by knowing it was intended to hold a Poultry Show at the Winter Show.

There were other features at the present Show well deserving observation, over which he must hasten—the samples of food, of manures, and of seeds; and, lastly, the extensive and beautiful exhibition of farming implements and machinery: all these several classes showed abundantly the amount of science, skill, and capital, which was being largely applied to Irish agriculture.

When he found that last year alone cattle had increased in Ireland 245,000, sheep 575,000, and pigs 187,000, giving an estimated increased value of £2,360,000 to our live stock for the one year; and recollected, at the same time, our happy exemption from the dire plague which carried devastation into so many parts of England, he might say, whatever clouds might lour, he thanked God, and took courage.

It was singular to observe at these Shows how scattered the blue ribbons of the Society spread themselves over Ireland, and even England. In 1862 they were borne off by Dublin, by the late lamented George Roe; in 1863 they went to Colonel Towneley, to Lancashire; in 1864, to Munster; in 1865, to Ulster; in 1866, we had no Show; in 1867, to Meath. Equally varied have been the distribution of our other prizes, showing how, in fact, all Ireland, from north to south, and from east to west, is being gradually stocked from the best blood of the day, and how every part of the kingdom is in a position to compete for the highest distinction as breeders of the best stock.

The Society had not yet sent its blue ribbon to the north-west of Ireland; and he

might just delicately observe, that should His Excellency, at their next Show, do them the honour of entering the list, and be fortunate enough to carry away the prize, so honourably won to-day by Mr. Chaloner, the motto of his house—" *Sola nobilitas virtus*"—could never be more appropriately borne.

In conclusion, he might say, the career of the Royal Dublin Society was now, as it had been for 130 years, one of patient and unceasing usefulness. Its mission in agriculture, as in science, in literature, and the arts, is to teach in the spirit of Bacon; and, in the language of Macaulay, that " The world is full of secrets of high moment to the happiness of man—that man had been by his Maker intrusted with the key, which, rightly used, would give access to them."

The Assistant Secretary then read the list of Prizes awarded.

R. C. Wade, J. P., Chairman of the Committee of Agriculture, proposed a vote of thanks to the Judges, and, in doing so, observed that they had discharged their difficult and important duties with a zeal and impartiality which had given general satisfaction. He referred to the absence of Poultry from the present Show, and explained that the Committee had decided upon having but one Show of Poultry in the year; and, upon consulting the poultry breeders as to the best time of the year for such Exhibition, they had decided in favour of the Christmas Show: the Committee had therefore simply acted in accordance with that opinion.

Mr. Allan Pollok, J. P., seconded the proposition.

His Excellency having put to the meeting the question of a vote of thanks to the Judges for the skill and impartiality with which they had discharged their duties, it was carried by acclamation.

Mr. Edward Bowly, one of the Judges of Short-horned Stock, in acknowledging the vote of thanks, said he never saw a finer show of yearling bulls than those exhibited on the present occasion; and he could assure the meeting, that, as they became spread over the country, a general improvement of stock would be the result. He felt bound to acknowledge the warm-hearted reception he had met with, on this his first visit to Ireland, at the hands of the people; and he felt sure that the more the people of the two countries saw of each other, the more clearly they would recognise the indentity of their interests, and would learn to entertain sentiments of mutual affection. Englishmen knew well how much the army and navy were indebted to Irish courage and bravery, and he would express a hope that they would all unite to maintain with hand and heart the glorous constitution under which they live.

Mr. R. Thornall, another of the Judges of Short-horns, also acknowledged the vote of thanks, and stated that he had the advantage of Mr. Bowly, in having been here on former occasions, and quite concurred in all that had fallen from that gentleman, when speaking of the excellence of the Show, which in some respects had not been surpassed by any that had preceded it.

The Earl of Clancarty rose, and said:—" May it please your Excellency—The business of the evening having now terminated, it remains for me, on the part of the Society, and I am sure I may add, of all here present, to express to you our thanks for your kindness in presiding here this evening. The interest your Excellency has on every opportunity evinced in the objects and proceedings of the Society, your visits to our exhibitions, and your now occupying the chair as the President of the institution, we greatly value, not alone for the honour of having you thus associated with us, but because your presence on such occasions enhances the value of any distinction (and none other is within the reach of the farmer) that as a successful competitor he may earn at our Cattle Shows; and it affords countenance and encouragement to those gentlemen who, giving their services upon our committees, are deserving of public thanks for their able, disinterested, patriotic, and unsparing exertions in carrying out the views of the Society. It is probably among the drawbacks upon any enjoyments that may attach to your Excellency's high office of Chief Governor of Ireland, that whatever evil may befall the country, as well as every public grievance, real or imaginary, is sure to be brought under your notice. If your Excellency's experience justifies this observation, I trust you have this day found relief in hearing about you only the language of congratulation and hopefulness, and in seeing that the country, under your government, presents, at least in the rearing of stock of the best description, unquestionable evidence of successful achievement. But the Society's Cattle Show this year tells favourably of the enterprise of the tenant farmers of Ireland, not only in the rearing of stock, but in the cultivation of the land. The farms from which the animals in the high condition we have seen them were drawn at this time of the year, are not mere grazing farms, but farms on which labour, skill, and capital have been expended in making the most of the soil for the production of food. Of this the splendid and varied assortments of farm implements, as well as of seeds and manures, that were this day brought under your Excellency's notice, afford further and conclusive proof; for these indispensable aids to high farming—the costly productions of mechanical and of chemical science—are not brought hither merely to be admired, but because the exhibiters believe that there are in Ireland farmers by whom they will be appreciated and purchased; and as it is from improved cultivation of the soil that increase of production is to be looked for, the future of Ireland is in this respect, I believe, very hopeful. In his enterprise, let me observe, that the Irish farmer is altogether unaided by Legislative encouragement; he enters into competition with the foreign producer, though under many disadvantages, self-reliant and asking no favour; and the same, I believe, may be said of every other branch of Irish enterprise or industry. I notice this, and I hope it may not be out of place here to do so, because our countrymen have been reproached, I think very unjustifiably, for being wanting in self-reliance, and for seeking aid from the State where they should help themselves. There are undoubtedly cases (but the rule applies to all parts of the United Kingdom) where Legislative powers and temporary advances from the Treasury are necessary for works of national importance. In such cases the State is to be regarded as the owner of a great estate, who, unless he would leave it unimproved, should extend every necessary aid to his tenantry in improving it. If, for example, a large district of country should be unimproved for want of arterial drainage, for which the owners and inhabitants have no power of making provision, but for which the State, and the State alone, can provide, it is scarcely just to say that Ireland is wanting in self-reliance, because the inhabitants of that district call upon the Government to do their part in affording every necessary facility for the work. Yet such, I am sorry to say, is the prejudice cherished in England against this country, that within my own experience, about three years ago, when I was, with other landowners of an extensive district in the West of Ireland, a memorialist to the Treasury for the necessary facilities for a work of arterial drainage, by which between 70,000 and 80,000 acres might be rendered available for cultivation, an answer was returned by their Lordships, in which they quoted from the opinion of Sir Charles Trevelyan, given in his evidence in 1848, before a Committee of the House of Commons, that with regard to Government loans for land improvement, "they nourish and perpetuate the habit of dependence upon others, which prevails to so great an extent in Ireland;" and their Lordships were further of opinion, with him, "that nothing could be done which would have so great a tendency to consolidate the empire, and to give a new spring to the energies of Ireland, as to cease to grant any public assistance of the kind whatever." It is needless to say that a memorial answered in such a spirit was unsuccessful, and that nearly 80,000 acres, that otherwise might now have been brought under profitable cultivation, and have sent hither their quota of valuable stock, adding to the resources for the feeding of England's hungry population, remain almost valueless, partly under water, and partly unprofitable swamp. I had lately the honour, at the head of a large and most respectable deputation of landowners from the same district, to bring this case under his Excellency's notice. I do not ask him here to say whether he deemed it a real or an imaginary grievance, but will now leave the subject, and conclude with congratulating his Excellency that he is presiding over a Society which is essentially self-reliant. It was the first of the kind established in the last century within the United Kingdom. Its object was, by the application of science to practice, to develope the resources of the country. Its usefulness after some years commended it to the notice of the Irish Parliament; and it is now, except in the department of husbandry, which is self-supporting, aided by public money in promoting generally a taste for literature, science, and art. Again thanking your Excellency for your kindness in presiding here this evening, I will now make way for my friend Mr. Waldron, whom I am happy to present to your Excellency as the successor of my son in the office of Honorary Secretary.

MR. WALDRON, D. L., briefly seconded the resolution.

His Excellency the Lord Lieutenant, the MARQUIS OF ABERCORN, rose, and said:—

My Lords and Gentlemen—I rise, in the first place, to return thanks to my noble friend (Lord Clancarty) for the very kind manner in which he proposed the vote of thanks on the occasion of my attending here to-night, and also to you for the kind and cordial manner in which you responded to that proposition. I assure you it is a matter of great satisfaction here in my place to preside for the first time in your Society. I have had the advantage on several occasions of being present at the Royal Agricultural Society; but I always regretted I was prevented attending the spring meeting here. Perhaps the pleasure I now feel in being present here for the first time is enhanced by being able to take the bright side of the picture, which I hope, notwithstanding Sir Charles Trevelyan's letter, my noble friend has so well described, and by being able to congratulate you upon the complete success of your show and exhibition this day. I believe the entries were only eighteen short of last year, while in short-horned bulls the entries were thirty-seven over those of last year. We have the testimony of Mr. Maunsell that the money received at the door was in excess of any former occasion. There was certainly this advantage attending this season. There were various reasons which seemed to indicate that the spring meeting of the present year might not be so favourable as in former years. We have had a winter of unusual severity; we have had nipping winds preventing the verdure of your fields, and almost the vegetation. We have had still more a disturbed state of the country, which for some months paralyzed the hand of the farmer, and has thrown uncertainty, doubt, and distrust upon all employments and avocations of peaceful and industrial life. While looking to these facts, the successful result of your meeting to-day is a subject of the highest satisfaction. It shows that the prosperity and strength of agriculture here are not built upon a flimsy or unsubstantial foundation, or liable to be subverted or disturbed by extraneous or fortuitous political events; but that the fostering care of societies like this, and the increase of skill and intelligence amongst all classes of farmers, have produced their fruits in the certainty of remunerative returns, and the increased improvement in agricultural skill and labour. Mr. Maunsell has with much ability described the showyard to-day. I need go no further than to say that, as usual, short-horns were in preponderance. We all bow with proper submission to Mr. Chaloner's Sovereign, which deserves at some future time to be the monarch of herds. I believe he might find some worthy mate among the many excellent animals in the yard. At all events, having regard to the quality of the stock exhibited, I should rather decline the challenge thrown out by Mr. Maunsell, even with the prospect of obtaining the blue ribbon in the distance. With regard to sheep, the entries have not been so numerous, but I believe they have been exceedingly good, many of the animals being of very high quality. In swine, the entries were more numerous. In short, the state of the showyard was most satisfactory. If we look further into the matter, we shall find that the evidence of the past year fully bears out the promises of the showyard to-day—the increasing improvement is the prominent feature which eminently and specially characterizes your Society as far as agriculture is concerned—namely, the improvement and increase of stock throughout the country. We find that in the three years since 1863 there has been an increase of 600,000 cattle, and the value of these cattle must not be estimated by its numerical increase, considering the value of cattle at the present time. The increase in sheep approaches one million, which must be also estimated upon an increased value as compared with former years. This is, so far, satisfactory. There is one point to which I look with some anxiety, which is well worthy the consideration of those who are able to take a more comprehensive view of subjects of this nature. I mean that, while cattle have increased in the last three years 600,000, and sheep to the extent of one million, the quantity of land under rotation of crops has decreased during the last six years by 450,000 acres, and the decrease of green crops alone is upwards of 150,000 acres, while there has been very little increase in hay and meadow lands. Therefore, there is some doubt whether so large an increase of cattle and sheep, without corresponding crops, may be an unmixed benefit, and may not tend rather to a rude than to a high and scientific mode of cattle farming. I venture to throw out these observations for those members of your Society who have more knowledge than I have upon this subject. My Lords and Gentlemen, there is another subject that has not been mentioned here to-night; but it is one to which the Society has devoted much care and attention—I mean the culture of flax. As one connected with a part of the country where it is very extensively grown, I would take the liberty of making a few observations on it. I believe there can be no doubt that flax, as it is cultivated in Ulster, is a most profitable crop for the small farmer, and by the small farmer I mean the man holding from 10 or 15 to 30 or 40 acres of land. But, while I assert that, I do not mean to convey that it is not also a crop profitable to the large farmer. There are special reasons why flax should be a crop more profitable to the small than to the large farmer; and amongst others may be mentioned the fact that the small farmer is able to use the unpaid labour of his family in the various processes of steeping, drying, and preparing for the scutcher, in which the small farmer's family usually display considerable skill and science, only to be acquired by long practice. The large farmer, however, is not so circumstanced; for he has to use paid labour—the ordinary hired labour, without the existence of that *esprit du corps* which is to be found among the members of the same family who work and labour together for a common object. It is, therefore, pretty clear that, though flax, like any other good crop, may be a profitable crop to the large farmer, it is to the small farmer essentially advantageous, and it is among the small farmers you should wish to see it extended. I now come to the question whether it is possible to introduce the culture of flax into the other three provinces, just as it has been cultivated in Ulster, and I confess I have some doubts as to whether it is practicable to introduce it to the same degree as in Ulster. If you look to the physical features of Ulster, you will find that it is, as a rule, a hilly country, and much intersected by small natural streamlets. In fact, flax requires as much water in its preparation as, judging by certain cases in the Lord Mayor's Court, milk requires for its perfection in Dublin. It is in consequence of this abundance of water in Ulster that the small farmer can have his own steeping place, or flax dam; and I much fear that in those parts of Ireland which, either from great extent of level surface, or the absence of these numerous streamlets, have not these advantages, you will find it difficult to get the small farmer to go vigorously into flax. Concomitant with this abundance of water in the flax-growing districts of Ulster are small mills for scutching, in every direction, within easy reach of every farmer, who is thus enabled to prepare his own produce and to speculate with in the markets on his own account, without the intervention of a go-between or trader. I believe that to be the pith and marrow of the small farmer's inclination for flax growing; and I fear that where these inclinations cannot be initiated, you will find it difficult to get flax extensively grown as a favourite crop. My Lords and Gentlemen, I venture to throw out these observations as one deeply interested in the prosperity of the country; because they explain, and perhaps suggest probable reasons for, the comparative failure which has taken place in the endeavour to increase the growth of flax in these provinces. There is another subject in which I take a deep interest, and in which this Society has displayed at different times considerable concern. While we spare nothing that skill, and science, and money can avail in the improvement of our herds and in the better cultivation of our fields, we must not forget those to whom the care of the cattle and the cultivation of the fields are entrusted—I mean the agricultural labourers of the country. I confess that, as a large proprietor of land, I have long felt that the improvement of the home of the agricultural labourers is a subject that must take a prominent part in the requirements of the present day. No doubt, the improvement of the farmers' homes would be advantageous, but the farmers are able, to a certain degree, to take care of themselves; while between them the labourer, the *adscriptus glebæ*, is apt to fall into very bad lodgings. I believe the condition of the labourer, as regards wages and diet, has been very much improved during the last twenty years—but I doubt whether another advantage, that of an improved home, has kept pace with it; and I very much fear that the old cabins of their forefathers shelter many labourers of the present day. While we regret the emigration that is taking so much of the bone and sinew of the land to other countries, it will be a question well worth the consideration of the philanthropic members of society, by what means, and how far, a better and more improved home would render the peasant comfortable and contented, and reconciled to remain on his native soil. No one knows better than I do the difficulty attending such a subject; but it is by the Royal Dublin Society, and by societies like it, it must be overcome; and it is a question that, in my opinion, would amply repay any care bestowed on it, in the increased comfort and content, and the improved condition, of a large portion of the population. It is satisfactory to us all to know that, in spite of an unusually inclement season, and of the disturbed state of a portion of the country, the ordinary avocations of the farmer are proceeding as peaceably as in ordinary years. We cannot but hope and believe that the softening influence of a bountiful and plentiful harvest may be in store for the disturbed and unsettled portion of our people. We deeply regret that some who have sown the whirlwind may reap the bitter and inevitable storm; but I believe we may have the confidence and assurance that you, as members of this society—and others, like myself, your fellow-labourers—will live to see the rewards of your labour, in an increased prosperity and improved state of the country, and in a happier and more contented condition of its people.

EVENING SCIENTIFIC MEETINGS.

Monday Evening, November 19, 1866.

Sir R. Griffith, Bart., F. R. S., in the Chair.

R. H. Scott, A. M., Keeper of the Minerals, read a paper by **Professor Heer**, of Zurich, "On the Miocene Flora of Atanekerdluk, in North Greenland," which was founded upon Collections of Fossil Leaves, presented to the Royal Dublin Society by Captain Colomb, and Sir Leopold F. M'Clintock.

Dr. Moore, Director of the Botanic Garden, exhibited specimens of a few of the living plants which are analogous to those referred to by Professor Heer. He stated that *Sequoia sempervirens*, nearly allied to the Californian Wellingtonia, which is a Sequioa, has produced cones in England.

E. Perceval Wright, M. D., observed that Dr. Hooker concludes that of about 600 Arctic species of plants 500 are Scandinavian. The present Flora of Greenland appears to be more European than American, and is very small as compared with the ancient Flora, which appears to have been extensive, and will no doubt be increased by future investigation.

Monday Evening, December 17, 1866.

Hon. George Handcock, V. P., in the Chair.

Dr. J. Emerson Reynolds read a paper, "On certain Absorption Spectra," illustrated on the screen by the Lime Light.

Dr. Reynolds also exhibited and explained the advantages in Photography of a new paper, called "Papier Leptographique."

Monday Evening, January 21, 1867.

John Barker, M. D., in the Chair.

Dr. Charles A. Cameron read a paper, "On the Substitution of Rubidia for Potash in Plants."

William Barker, M. D., exhibited a series of striking Experiments with Wilde's Electro-Magnetic Machine.

Monday Evening, February 18, 1867.

D. H. Kelly, D. L., in the Chair.

Mr. William Andrews—A paper, "On a Cetacean new to Ireland." The head of this animal, which is named *Ziphius Sowerbii* = the *Delphinorhyncus Sowerbii*, *Diodon Sowerbii* (Desmarest), *Delphinus micropterus* (Cuvier), *Diodon Desmaresti* (Risso), was obtained by Colonel the Hon. D. B. De Moleyns from Dr. Bustead, of Castle Gregory, Co. Kerry, who has thus described the discovery:—"It was on the morning of the 9th of March, 1864, that the animal, which with you I believe to be a Diodon, was cast on the sandy beach at Hillville (Brandon Bay, coast of Kerry), after a spring tide. I happened to be riding when I perceived two men in the water pulling at a strange object, which on inspection proved to be part of the head of some cetaceous animal, divided vertically behind the eyes, and the front portion only remaining. The rest of the body had been hewn into small pieces, and carried to their homes by the peasantry. In this, however, the eyes were perfect, as also the spiracle lunated, with the concavity looking forward. The measurements were—from centre of fold of spiracle to each eye, 10 inches; from same point to extremity of upper jaw, 22 inches; from commissure of lips to extremity of upper jaw, 18½ inches; from commissure of lips to extremity of lower jaw, 14 inches. On the lower surface of the integuments of the neck, between the rami of the lower jaw, was a well-defined angular space, formed by two depressed lines, each 10 inches long, converging to an apex in front and behind, distant 7 inches from each other. It is much to be regretted that the remainder of the head could not be procured, nor any of the rest of the skeleton."

J. Beete Jukes, A. M., read a paper by the late Mr. Frederick F. Foot, entitled "Notes of a Tour in Norway during the Summer of 1866."

Monday Evening, March 18, 1867.

John Good in the Chair.

Joseph Maguire, Architect, read a paper "On Healthy Dwellings for Labourers, Artisans, and the Middle Classes, and their improved Structural Arrangements."

Mr. Stephen M. Yeates exhibited a new Thermo-Electric Battery, of great energy, made on M. S. Marcus' plan, in which the bars forming the couples are composed of two alloys, the positive bar being an alloy of copper, zinc, and nickel; the negative, an alloy of antimony, zinc, and bismuth. As the fusing point of the negative bar is about 600° C., and that of the positive much higher, a very considerable heat can be applied to the end of the pile, and thus a powerful current produced, without the inconvenience of reducing the temperature of the other end below that of the surrounding air.

At one end of the battery all the positive plates project beyond the negative, for the convenience of heating them by means of a row of very minute gas jets. By this contrivance a very uniform temperature can be maintained for a long time.

The battery on the table consists of thirty-six couples; and, when one end is heated by the gas jets, the other remains at the present temperature of the room: the current thus produced will disengage nearly one cubic inch of gas per minute, and, when connected with a small electro-magnet, will give a lifting power of 60 lbs.

MONDAY EVENING, MAY 20, 1867.

THE REV. H. LLOYD, D. D., Provost of Trinity College, V. P., in the Chair.

Mr. GEORGE JOHNSTONE STONEY gave an account of the recent surprising Discoveries in Meteoric Astronomy.

DR. J. EMERSON REYNOLDS read a paper, on "A Remarkable Isomer of Sulpho-Cyanogen."

WEDNESDAY EVENING, MAY 22, 1867.

DR. H. ROBERT DE RICCI, in the Chair.

EDMUND CULLEN, M. D., read a paper on "The Darien Canal Line."

DR. J. EMERSON REYNOLDS, Keeper of the Minerals, read a communication on "An Apparatus for the Estimation of Carbonic Acid, and for the Valuation of Manganese Ores."

SEPTEMBER, 1866.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Saturday, ...	29·640	60	64	62	65	49	N. W.	8	Many, . .	Broken, . .	·050	Breezy, and changeable.
2 Sunday, ...	29·580	59	61	59	61	46	N. W.	4	Do. . .	Do. . . .	·040	Rain A. M., fair P. M.
3 Monday, ...	29·520	60	64	62	65	48	S. W.	6	Do. . .	Do. . . .	·030	Fair, but changeable.
4 Tuesday, ...	29·800	59	63	61	64	48	S. W.	8	Do. . .	Do. . . .	·020	Do.
5 Wednesday, . . .	29·150	57	60	58	60	46	S. W.	3	Do. . .	Do. . . .	·300	Heavy rain.
6 Thursday, ...	29·170	55	56	54	56	51	E.	0	Do. . .	Do. . . .	·560	Do.
7 Friday, ...	29·640	59	61	60	61	51	N. W.	7	Do. . .	Do. . . .	·010	Very fine day.
8 Saturday, ...	29·800	59	62	61	62	42	N. W.	8	Do. . .	Do. . . .	. .	Do.
9 Sunday, ...	29·500	58	60	58	60	43	W.	0	Do. . .	Do. . . .	·360	Dull, wet day.
10 Monday, ...	29·200	57	60	58	61	42	W.	2	Do. . .	Do. . . .	·380	Do.
11 Tuesday, ...	29·634	56	68	67	60	50	N. W.	4	Do. . .	Do. . . .	·080	Do.
12 Wednesday, . . .	29·580	53	55	53	57	47	S. E.	0	Do. . .	Do. . . .	·290	Do.
13 Thursday, ...	29·640	54	58	56	60	49	W.	4	Do. . .	Do. . . .	·020	Fine, but changeable.
14 Friday, ...	29·500	57	60	58	60	47	S. W.	3	Do. . .	Do. . . .	·030	Do.
15 Saturday, ...	29·300	58	62	60	62	50	S. W.	4	Do. . .	Do. . . .	·310	Heavy showers during day.
16 Sunday, ...	29·300	56	59	57	60	47	S. W.	3	Do. . .	Do. . . .	·120	Dull, and changeable.
17 Monday, ...	29·310	57	59	57	59	45	W.	4	Do. . .	Do. . . .	·420	Heavy rain during day.
18 Tuesday, ...	29·280	55	58	56	59	44	S. W.	3	Do. . .	Do. . . .	·040	Showers frequent.
19 Wednesday, . . .	29·200	57	59	57	59	45	S. W.	0	Do. . .	Do. . . .	·020	Do.
20 Thursday, ...	29·216	58	60	58	60	43	W.	2	Do. . .	Do. . . .	·010	Do.
21 Friday, ...	29·300	55	59	57	60	43	W.	4	Do. . .	Do. . . .	·080	Fine, but changeable.
22 Saturday, ...	29·320	55	60	58	62	40	W.	6	Do. . .	Do. . . .	·130	Fine A. M., rain P. M.
23 Sunday, ...	29·350	57	59	57	60	40	S. W.	4	Do. . .	Do. . . .	·010	Do.
24 Monday, ...	29·600	57	60	59	61	39	S. W.	8	Do. . .	Do. . . .	·030	Stormy and showery.
25 Tuesday, ...	29·540	61	62	61	63	47	S. W.	8	Do. . .	Do. . . .	·010	Do.
26 Wednesday, . . .	29·690	58	60	57	62	52	S. W.	6	Do. .	Do. . .	. .	Breezy, fine day.
27 Thursday, ...	29·700	59	61	59	63	49	S. W.	8	Do. . .	Do. . . .	. .	Do.
28 Friday, ...	29·750	60	63	62	63	42	S. E.	6	Do. . .	Do. . . .	. .	Do.
29 Saturday, ...	29·900	58	60	59	62	40	S. W.	4	Do. . .	Do. . . .	. .	Do.
30 Sunday, ...	30·200	57	59	58	60	41	S. E.	9	Few, . .	Do. . . .	. .	Fine, sunshiny day.
								136	Total Amount of Rain,		3·350	inches.

OCTOBER, 1866.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Monday, ...	30·050	55	59	58	60	35	E.	0	Many, . .	Broken, . .	·010	Dull, and hazy.
2 Tuesday, ...	30·050	57	61	60	61	54	E.	8	Few, . .	Do. . . .	. .	Foggy A. M., clear P. M.
3 Wednesday, . .	30·050	58	60	59	62	50	S. E.	2	Many, . .	Do. . . .	. .	Dull, and changeable.
4 Thursday, . . .	30·150	59	60	59	61	51	S. E.	3	Do. . .	Do. . . .	. .	Do.
5 Friday, ...	30·350	56	59	58	59	52	N. E.	4	Do. . .	Do. . . .	. .	Calm, and mild.
6 Saturday, . . .	30·450	57	59	58	59	53	N. E.	3	Do. . .	Do. . . .	. .	Do.
7 Sunday, ...	30·430	58	60	59	61	47	N.	6	Do. . .	Do. . . .	. .	Very fine day.
8 Monday, ...	30·350	56	58	57	60	49	N. E.	6	Do. . .	Do. . . .	. .	Do.
9 Tuesday, ...	30·200	54	56	55	59	40	N.	5	Do. . .	Do. . . .	. .	Dull, and changeable.
10 Wednesday, . .	30·060	53	55	53	58	41	N. E.	0	Do. . .	Do. . . .	. .	Dull, and gloomy.
11 Thursday, . . .	30·050	53	55	54	56	50	N.	2	Do. . .	Do. . . .	. .	Do.
12 Friday, ...	29·980	52	55	54	55	47	E.	0	Do. . .	Do. . . .	. .	Dull, and mild.
13 Saturday, . . .	29·850	54	57	56	60	44	N. W.	4	Do. . .	Do. . . .	. .	Do.
14 Sunday, ...	30·028	47	50	49	50	42	N. E.	3	Few, . .	Do. . . .	·420	Fine, mild day.
15 Monday, ...	30·100	48	57	50	51	31	N.	8	Do. . .	Do. . . .	. .	Fine, clear day.
16 Tuesday, . . .	30·020	51	54	50	54	32	S. E.	3	Many, . .	Do. . . .	. .	Breezy, and changeable.
17 Wednesday, . .	29·650	54	56	54	56	43	S. E.	0	Do. . .	Do. . . .	·220	Very stormy day.
18 Thursday, . . .	29·600	55	58	56	58	51	S. E.	0	Do. . .	Do. . . .	·310	Do.
19 Friday, ...	29·820	58	59	58	60	51	S. W.	6	Do. . .	Do. . . .	. .	Dull, and changeable.
20 Saturday, . . .	29·870	57	58	57	60	51	S. E.	3	Do. . .	Do. . . .	. .	Do.
21 Sunday, ...	29·870	58	61	60	61	42	S. W.	8	Do. . .	Do. . . .	·110	Fine, mild day.
22 Monday, ...	29·850	53	55	54	59	41	S. W.	6	Do. . .	Do. . . .	·020	Do.
23 Tuesday, . . .	30·000	57	58	57	59	41	S. W.	6	Do. . .	Do. . . .	. .	Dull, and changeable.
24 Wednesday, . .	29·576	46	47	45	48	39	S. W.	6	Do. . .	Do. . . .	·130	Showery day.
25 Thursday, . . .	29·750	46	46	45	49	32	W.	8	Do. . .	Do. . . .	. .	Clear A. M., frost P. M.
26 Friday, ...	29·860	51	54	52	56	32	W.	0	Do. . .	Do. . . .	. .	Dull, and changeable.
27 Saturday, . . .	29·890	55	57	56	57	42	S. W.	0	Do. . .	Do. . . .	·110	Do.
28 Sunday, ...	30·278	49	51	50	58	40	N. W.	8	Do. . .	Do . . .	·020	Fine, breezy day.
29 Monday, ...	30·050	50	51	49	52	41	S. W.	0	Do. . .	Do. . . .	. .	Very changeable.
30 Tuesday, ...	29·040	47	48	47	52	48	W.	8	Do. . .	Do. . . .	·070	Breezy, fine day.
31 Wednesday, . .	29·850	55	56	50	8	34	S. W.	6	Do. . .	Do. . . .	. .	Do.
								122	Total Amount of Rain,		1·420	Inches.

NOVEMBER, 1866.

DATE.	BAROMETER.	THERMOMETER.					WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Thursday, ...	29·750	45	47	45	48	40	N. W.	6	Many, . .	Broken, . .	·130	Breezy, and changeable.
2 Friday, ...	29·750	46	48	47	50	42	N. W.	4	Do. . .	Do. . . .	·260	Do.
3 Saturday, ...	29·780	46	49	48	48	42	W.	2	Do. . .	Do. . . .	·210	Do.
4 Sunday, ...	29·790	48	49	48	51	45	N. W.	3	Do. . .	Do. . . .	·110	Fine, but changeable.
5 Monday, ...	29·794	47	49	48	50	41	W.	4	Do. . .	Do. . . .	·020	Do.
6 Tuesday, ...	29·860	50	51	50	52	40	W.	6	Do. . .	Do. . .	. .	Breezy, fine day.
7 Wednesday, . . .	29·990	49	50	49	53	39	W	4	Do. . .	Do. . . .	·120	Very stormy day.
8 Thursday, ...	29·720	47	50	48	50	44	N. W.	6	Do. . .	Do. . . .	·030	Fine, mild day.
9 Friday, ...	29·650	45	48	47	48	42	N. W.	6	Do. . .	Do. . . .	. .	Do.
10 Saturday, ...	29·650	44	46	45	48	29	S. E.	2	Do. . .	Do. . . .	·050	Frost A. M., showery P. M.
11 Sunday, ...	29·788	47	50	48	52	40	W.	6	Do. . .	Do. . . .	. .	Chilly, cold day.
12 Monday, ...	29·590	47	49	47	50	40	S. W.	0	Do. . .	Do. . . .	. .	Dull, and gloomy.
13 Tuesday, ...	29·590	44	45	44	46	44	W.	0	Do. . .	Do. . . .	. .	Do.
14 Wednesday, . . .	30·090	42	42	41	45	39	N. W.	7	Do. . .	Do. . . .	. .	Clear, like frost.
15 Thursday, ...	29·860	43	44	43	46	40	W.	6	Do. . .	Do. . . .	·030	Fine, but changeable.
16 Friday, ...	29·620	48	50	44	52	42	N. W.	0	Do. . .	Do. . . .	·060	Dull, and cloudy.
17 Saturday, ...	29·840	45	47	45	47	31	W.	0	Do. . .	Do. . . .	·020	Do.
18 Sunday, ...	29·950	45	46	45	46	38	N. W.	2	Do. . .	Do. . . .	·170	Rain A. M., fair P. M.
19 Monday, ...	30·100	39	41	40	42	34	N. W.	6	Do. . .	Do. . . .	. .	Clear, like frost.
20 Tuesday, ...	30·190	41	42	41	43	29	N.	5	Do. . .	Do. . . .	. .	Dull, and changeable.
21 Wednesday, . . .	30·090	43	45	44	45	34	W.	5	Do. . .	Do. . . .	. .	Fine, breezy day.
22 Thursday, ...	30·050	44	45	44	45	40	W.	5	Do. . .	Do. . . .	. .	Do.
23 Friday, ...	29·720	46	49	47	49	43	W.	4	Do. . .	Do. . . .	·030	Showery day.
24 Saturday, ...	29·720	47	48	47	49	36	W.	2	Do. . .	Do. . . .	·010	Breezy, and showery.
25 Sunday, ...	29·500	42	43	41	45	39	S. W.	2	Do. . .	Do. . . .	·070	Showery day.
26 Monday, ...	30·000	44	46	45	44	40	S. W.	0	Do. . .	Do. . . .	. .	Breezy, and overcast.
27 Tuesday, ...	30·090	49	50	49	50	40	W.	3	Do. . .	Do. . . .	. .	Do.
28 Wednesday, . . .	30·090	50	51	50	52	40	W.	0	Do. . .	Do. . . .	. .	Dull, and cloudy.
29 Thursday, . . .	29·980	49	51	50	52	31	S. W.	0	Do. . .	Do. . . .	. .	Frost A. M., mild P. M.
30 Friday, ...	29·750	45	47	46	49	41	S. E.	0	Do. . .	Do. . . .	. .	Strong breeze, changeable.
								96	Total Amount of Rain.		1·320	inches.

DECEMBER, 1866.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Saturday, ...	29·650	40	41	40	43	38	S. E.	4	Many, . .	Broken, . .	. .	Fine, mild day.
2 Sunday, ...	29·540	43	44	43	44	32	S.	3	Do. . .	Do. . . .	·030	Fair A. M., rain P. M.
3 Monday, ...	29·628	51	52	50	55	39	S. W.	2	Do. . .	Do. . . .	·100	Stormy, wet day.
4 Tuesday, ...	29·460	55	56	55	57	47	S. W.	0	Do. . .	Do. . . .	·120	Do.
5 Wednesday, . . .	29·610	44	45	44	46	45	W.	0	Do. . .	Do. . . .	. .	Mild, and changeable.
6 Thursday, . . .	29·500	46	48	46	48	45	W.	0	Do. . .	Do. . . .	·380	Stormy, wet day.
7 Friday, ...	29·584	45	46	45	47	31	N. W.	4	Do. . .	Do. . . .	·120	Stormy, and showery.
8 Saturday, . . .	29·600	46	48	47	48	32	S. W.	4	Do. . .	Do. . . .	·030	Frost A. M., changeable P. M.
9 Sunday, ...	29·800	53	55	54	55	40	S. W.	3	Do. . .	Do. . . .	. .	Dull, and changeable.
10 Monday, ...	30·150	42	43	42	48	41	W.	6	Few, . .	Do. . . .	. .	Clear, like frost.
11 Tuesday, ...	30·090	42	45	43	46	29	S. E.	0	Many, . .	Do. . . .	·010	Frost A. M., rain P. M.
12 Wednesday, . . .	29·660	50	51	50	53	44	W.	6	Few, . .	Do. . . .	·170	Strong breeze, fine day.
13 Thursday, . . .	29·400	47	50	48	52	39	S. W.	4	Many, .	Do. . . .	·050	Overcast, changeable.
14 Friday, ...	29·280	44	45	44	46	44	S. W.	0	Do. . .	Do. . . .	·030	Strong breeze, changeable.
15 Saturday, . . .	29·250	45	46	45	46	41	S. W.	5	Few, . .	Do. . . .	·110	Showery, cold day.
16 Sunday, ...	29·700	45	47	46	47	41	S. W.	4	Many, . .	Do. . . .	. .	Fine, mild day.
17 Monday, ...	29·900	55	57	56	58	43	S. W.	2	Do. . .	Do. . . .	·010	Breezy, and changeable.
18 Tuesday, ...	29·890	54	55	54	56	52	S. W.	6	Do. . .	Do. . . .	·010	Do.
19 Wednesday, . .	30·250	43	45	44	49	37	S. W.	7	Do. . .	Do. . . .	·120	Brisk breeze, chilly.
20 Thursday, . . .	30·250	49	50	59	52	38	S. W.	6	Do. . .	Do. . . .	. .	Fine, mild day.
21 Friday, ...	30·180	50	52	51	50	50	W.	0	Do. . .	Do. . . .	. .	Do.
22 Saturday, . . .	30·300	40	42	41	44	32	S. W.	3	Do. . .	Do. . . .	. .	Dull, and changeable.
23 Sunday, ...	30·160	47	49	48	50	35	S. W.	6	Do. . .	Do. . . .	. .	Fine, mild day.
24 Monday, ...	30·010	49	50	49	51	45	S. W.	4	Do. . .	Do. . . .	. .	Do.
25 Tuesday, ...	29·850	52	53	52	55	38	S. W.	4	Do. . .	Do. . . .	·050	Rain A. M., fair P. M.
26 Wednesday, . . .	29·500	45	48	46	48	40	N. W.	3	Do. . .	Do. . . .	·020	Wet, and stormy.
27 Thursday, . . .	29·840	48	49	48	50	41	W.	2	Do. . .	Do. . . .	·110	Stormy day.
28 Friday, ...	29·950	50	51	49	51	47	W.	0	Do. . .	Do. . . .	. .	Breezy, and changeable.
29 Saturday, . . .	29·420	45	46	44	48	45	N. W.	2	Do. . .	Do. . . .	·020	Showery day.
30 Sunday, ...	29·190	48	44	43	46	39	N. W.	3	Do. . .	Do. . . .	. .	Cold, breezy day.
31 Monday, ...	29·300	36	36	35	39	31	N.	2	Do. . .	Do. . . .	·120	Snow A. M., rain P. M.
								95	Total Amount of Rain, 1·510 inches.			

JANUARY, 1867.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.			
1 Tuesday, ...	29·140	31	32	31	34	23	W.	0	·110	Cold, and snowy.
2 Wednesday, . . .	29·440	25	25	24	28	26	N. W.	4	·020	Snow A. M., clear P. M.
3 Thursday, ...	29·730	19	20	19	27	14	W.	6	. .	Keen frost.
4 Friday, ...	29·840	28	30	29	30	9	W.	4	. .	Snow showers, very stormy.
5 Saturday, ...	29·450	34	35	34	36	25	S. E.	0	. .	Fair A. M., rain P. M.
6 Sunday, ...	28·720	47	48	46	49	33	S. W.	3	. .	Do.
7 Monday, ...	28·700	50	52	50	53	41	S. W.	5	1·100	Mild, and changeable.
8 Tuesday, ...	28·680	44	44	43	48	43	S. W.	4	·070	Breezy, and changeable.
9 Wednesday, . . .	28·750	39	40	39	42	39	N. W.	0	·520	Gloomy, wet day.
10 Thursday, ...	29·420	37	39	38	40	34	N. W.	6	·040	Clear, like frost.
11 Friday, ...	29·820	33	33	42	35	29	N. W.	6	. .	Do.
12 Saturday, ...	29·700	25	25	24	33	26	N. W.	6	. .	Snow showers, very cold.
13 Sunday, ...	29·710	26	27	26	32	25	N. W.	5	. .	Clear, and frosty.
14 Monday, ...	29·916	31	31	30	33	21	N. W.	6	. .	Do.
15 Tuesday, ...	29·980	29	29	28	31	17	N. W.	6	. .	Do.
16 Wednesday, . . .	29·826	31	31	30	33	26	S. E.	0	. .	Snow showers frequent.
17 Thursday, ...	29·550	26	26	25	32	16	N. W.	5	. .	Keen frost.
18 Friday, ...	29·530	30	31	30	32	19	N. W.	6	. .	Snow A. M., frost P. M.
19 Saturday, ...	29·750	34	35	34	36	19	E.	0	. .	Dull and gloomy, thawing.
20 Sunday, ...	29·750	33	34	33	35	30	E.	3	. .	Breezy, light thaw.
21 Monday, ...	29·750	34	34	33	36	31	S. E.	4	. .	Do.
22 Tuesday, ...	29·650	36	37	35	37	32	S. E.	0	·200	Breezy, and thawing.
23 Wednesday, . . .	29·288	48	50	48	51	36	S. E.	0	·280	Fine, mild day.
24 Thursday, ...	29·200	51	52	50	52	45	S. W.	6	·110	Do.
25 Friday, ...	29·700	44	44	43	45	41	W.	5	. .	Breezy, fine day.
26 Saturday, ...	29·640	50	52	50	52	38	S. W.	0	·270	Gloomy, wet day.
27 Sunday, ...	29·600	53	55	53	56	46	W.	0	·040	Gloomy, and changeable.
28 Monday, ...	29·610	47	48	46	50	45	W.	3	·050	Very stormy, and showery.
29 Tuesday, ...	29·580	52	53	52	54	41	S. W.	5	·030	Showery A. M., fair P. M.
30 Wednesday, . . .	29·440	44	45	43	45	43	N. W.	0	·050	Dull, gloomy, overcast.
31 Thursday, ...	29·900	45	47	44	47	35	S. W.	4	·040	Do.
								103	2·930	inches.

FEBRUARY, 1867.

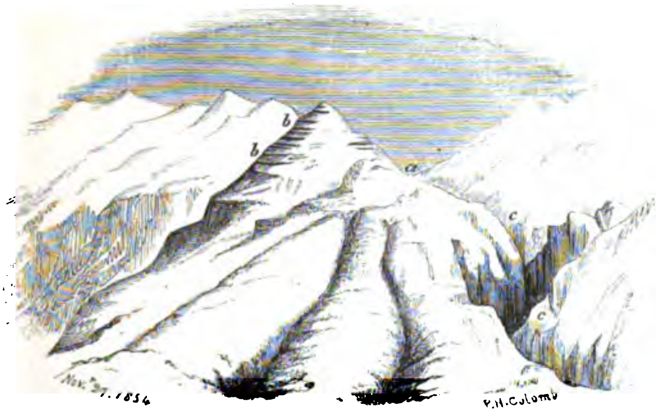
DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.			
1 Friday, ...	29·750	53	54	52	57	40	S. W.	2	·020	Changeable A. M., rain P. M.
2 Saturday, . . .	30·250	44	45	44	47	40	W.	6	·010	Breezy, fine day.
3 Sunday, ...	29·420	45	47	45	50	36	W.	5	. .	Fine A. M., overcast P. M.
4 Monday, ...	29·374	41	42	40	44	39	W.	4	·080	Fine, breezy day.
5 Tuesday, . . .	28·918	45	46	44	45	34	S. W.	0	. .	Gloomy and overcast.
6 Wednesday, . .	28·800	39	39	37	40	39	W.	0	·300	Cold, and overcast.
7 Thursday, . . .	29·478	41	43	42	44	34	S. W.	0	·140	Do.
8 Friday, ...	29·172	46	46	45	49	34	S. W.	4	·540	Breezy, fine day.
9 Saturday, . . .	29·770	45	46	45	47	38	S.	2	·010	Fine, mild day.
10 Sunday, ...	29·900	49	51	50	53	40	S. W.	4	·020	Fair A. M., rain P. M.
11 Monday, ...	29·980	47	48	47	49	32	S. W.	0	·180	Gloomy, and changeable.
12 Tuesday, ...	30·200	50	51	50	51	46	S. W.	0	. .	Do.
13 Wednesday, . .	30·270	51	52	51	52	42	S. W.	0	. .	Fine, mild day.
14 Thursday, . . .	30·150	47	48	47	49	46	S. E.	0	. .	Breezy, and changeable.
15 Friday, ...	29·640	47	49	48	49	38	S. E.	2	. .	Dull, and changeable.
16 Saturday, . . .	29·640	48	49	49	50	44	S. E.	4	·060	Fine, and mild.
17 Sunday, ...	30·000	47	48	47	50	37	S. E.	0	. .	Dull, and changeable.
18 Monday, ...	30·200	48	49	48	51	46	S. E.	0	·020	Fair A. M., rain P. M.
19 Tuesday, ...	30·100	52	54	53	54	47	S. W.	4	. .	Fine, breezy day.
20 Wednesday, . .	30·350	54	55	54	56	40	S. W.	4	. .	Do.
21 Thursday, . . .	30·378	53	54	53	55	50	S. W.	0	·010	Light rain, gloomy, mild.
22 Friday, ...	30·260	53	54	53	56	47	W.	0	. .	Fine, mild day.
23 Saturday, . . .	30·350	50	52	51	54	50	W.	6	. .	Do.
24 Sunday, ...	30·180	47	49	48	50	39	S. W.	6	·020	Rain A. M., fair P. M.
25 Monday, ...	29·984	48	49	48	51	37	W.	3	. .	Breezy, rather cold.
26 Tuesday, . . .	29·950	46	48	46	51	37	W.	0	·040	Dull, and gloomy.
27 Wednesday, . .	29·950	37	39	37	42	36	S.	0	·050	Drizzling rain, cold.
28 Thursday, . . .	30·200	40	42	41	42	38	S. E.	0	·030	Do.
								56	1·380	inches.

MARCH, 1867.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	RAIN.	WEATHER, AND GENERAL REMARKS.
Day. At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.			
1 Friday,.	30·480	44	47	46	47	28	S. E.	6	. .	Frost A. M., fine P. M.
2 Saturday,. . . .	30·510	43	44	43	49	30	S. E.	7	. .	Do.
3 Sunday, ...	30·512	46	49	48	49	25	E.	7	. .	Do.
4 Monday, ...	30·400	48	48	47	48	32	N. E.	0	. .	Dull, and changeable.
5 Tuesday, ...	30·188	42	44	43	48	40	N. E.	3	. .	Fair, breezy, very cold.
6 Wednesday,. . .	29·830	42	43	42	45	39	N. E.	6	·010	Do.
7 Thursday, . . .	29·690	38	39	37	43	34	N. E.	3	·240	Sleety showers, very cold.
8 Friday,.	29·560	36	37	36	40	35	N. E.	0	·130	Do.
9 Saturday,. . . .	29·400	37	38	37	40	34	N. E.	4	·190	Do.
10 Sunday, ...	29·670	39	40	38	40	32	E.	5	·080	Dull, and gloomy, light rain.
11 Monday, ...	29·540	35	36	35	38	35	E.	0	·170	Do.
12 Tuesday, ...	29·688	37	38	37	39	33	N. E.	0	·050	Stormy, and showery.
13 Wednesday, . .	29·584	34	35	34	39	30	N. E.	2	·020	Snow A. M., changeable P. M.
14 Thursday, . . .	29·710	35	36	35	37	32	N. E.	0	·090	Do.
15 Friday,.	29·800	36	38	37	39	33	N. E.	5	·020	Snow A. M., clear, like frost, P. M.
16 Saturday, . . .	29·950	36	37	36	40	27	N. E.	7	. .	Fine, clear, like frost.
17 Sunday, ...	29·600	36	38	37	39	30	E.	6	. .	Strong breeze, very cold.
18 Monday, ...	29·350	32	33	32	35	32	E.	0	·020	Snow falling all day.
19 Tuesday, ...	29·380	35	37	36	38	33	N. E.	0	·090	Dull and cloudy, thawing P. M.
20 Wednesday, . .	29·640	36	38	37	39	34	N. E.	5	·010	Snow showers, thawing, strong breeze.
21 Thursday, . . .	29·500	36	37	36	39	33	N. E.	3	·010	Strong breeze A. M., changeable P. M.
22 Friday, ...	29·450	45	46	44	50	34	N. E.	4	·700	Snow A. M., rain P. M.
23 Saturday, . . .	29·120	49	51	49	52	41	S.	0	1·140	Very wet day.
24 Sunday, ...	29·400	54	56	55	59	38	S. W.	6	. .	Fine, mild day.
25 Monday, ...	29·182	50	51	49	55	39	S.	4	·270	Heavy rain, A. M., fair P. M.
26 Tuesday, ...	29·150	49	50	48	55	45	W.	3	·240	Showery A. M., fair, stiff breeze, P. M.
27 Wednesday, . . .	29·160	46	49	47	50	41	W.	6	·030	Fine, breezy day.
28 Thursday, . . .	29·270	45	45	44	49	33	W.	2	·170	Showery day.
29 Friday,.	29·574	46	48	47	48	35	N. W.	6	·010	Fine, breezy day, showery.
30 Saturday,. . . .	29·740	46	48	47	49	40	W.	6	·030	Very stormy, and showery.
31 Sunday, ...	30·150	50	51	50	52	40	S. W.	9	. .	Fine, mild day.
								116	3·720	inches.

APRIL, 1867.

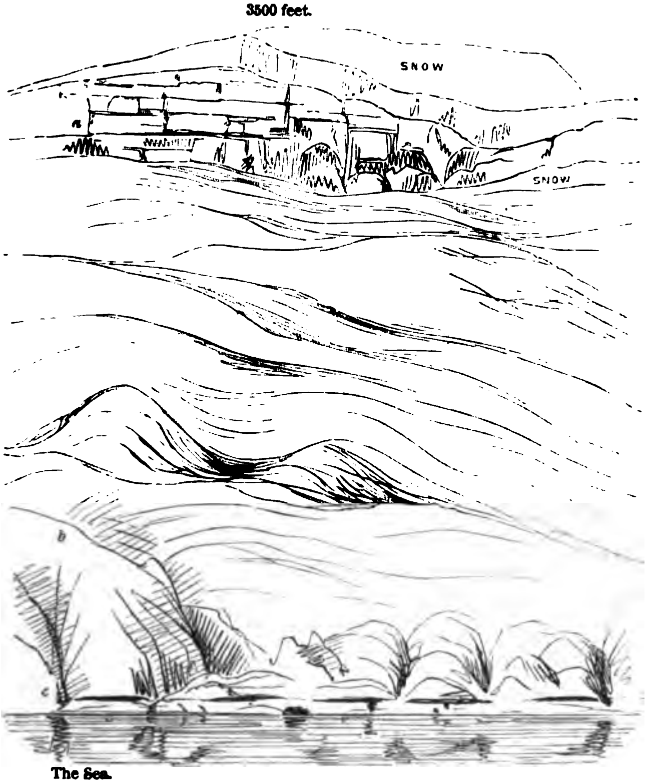
DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.			
1 Monday, . . .	30·222	60	62	61	62	46	S. W.	4	. .	Strong breeze, fine day.
2 Tuesday, . . .	30·220	58	59	58	63	52	N. W.	9	. .	Do.
3 Wednesday, . .	30·120	54	57	56	59	45	S. W.	2	. .	Stiff breeze, showery, fine day.
4 Thursday, . . .	29·840	52	54	52	58	49	N. W.	6	·030	Strong breeze, fine day.
5 Friday, ...	29·950	58	61	60	61	45	N.	7	. .	Fine, breezy day.
6 Saturday, . . .	29·920	56	59	58	61	49	N.	8	. .	Do.
7 Sunday, . . .	29·600	56	58	57	59	44	S. W.	0	·010	Dull, and mild.
8 Monday, . . .	29·326	57	47	46	51	45	W.	6	·060	Very stormy, showery, hail, cold.
9 Tuesday, . . .	29·718	49	51	50	51	42	N. W.	7	·040	Do.
10 Wednesday, . .	29·810	47	49	48	51	41	W.	6	·010	Fine, breezy day.
11 Thursday, . . .	29·800	48	50	49	53	39	N. W.	7	·020	Do.
12 Friday, ...	29·600	45	48	46	54	32	W.	6	·010	Strong breeze, fine day.
13 Saturday, . . .	29·410	44	46	44	49	37	W.	7	·020	Do.
14 Sunday, . . .	29·300	43	45	43	47	41	W.	3	·460	Very stormy, heavy rain.
15 Monday, . . .	29·380	45	47	45	52	44	W.	7	·160	Do.
16 Tuesday, . . .	29·584	54	56	45	57	44	S. W.	3	·070	Do.
17 Wednesday, . .	29·800	54	58	57	59	48	W.	6	·040	Drizzling rain A. M., fine and mild P. M.
18 Thursday, . . .	29·528	50	51	50	54	49	S. W.	0	·080	Very wet day.
19 Friday, ...	29·200	57	59	57	60	49	S. W.	7	010	Showery A. M., fine and breezy P. M.
20 Saturday, . .	29·050	45	48	46	54	44	N. W	4	·030	Showery, and mild.
21 Sunday, . . .	29·470	45	47	45	50	37	W.	4	·090	Showery, and changeable.
22 Monday, . . .	29·400	54	57	55	60	39	W.	3	·070	Do.
23 Tuesday, . . .	29·480	59	61	60	63	40	S. W.	9	·020	Strong breeze, showery, fine day.
24 Wednesday, . .	29·480	56	60	59	60	48	N. W.	7	·060	Mild, and showery.
25 Thursday, . . .	29·770	48	51	50	55	42	N. E.	8	·040	Fine, clear day.
26 Friday, ...	29·450	47	48	47	50	42	S. E.	0	·700	Very wet day.
27 Saturday, ...	29·350	46	49	47	52	42	S. W.	6	·510	Fine A. M., heavy rain and hail P. M.
28 Sunday, ...	29·780	50	54	51	55	33	S. W.	10	. .	
29 Monday, . . .	29·620	51	52	51	54	35	S. E.	5	. .	
30 Tuesday, . . .	29·620	48	49	48	52	41	S. W.	0	·260	
								157	2·800	inches.



SKETCH OF PEAK AT ATANEKERDLUK,

Elevated 1080 feet above the sea, round the base of which the fossil leaves were found.

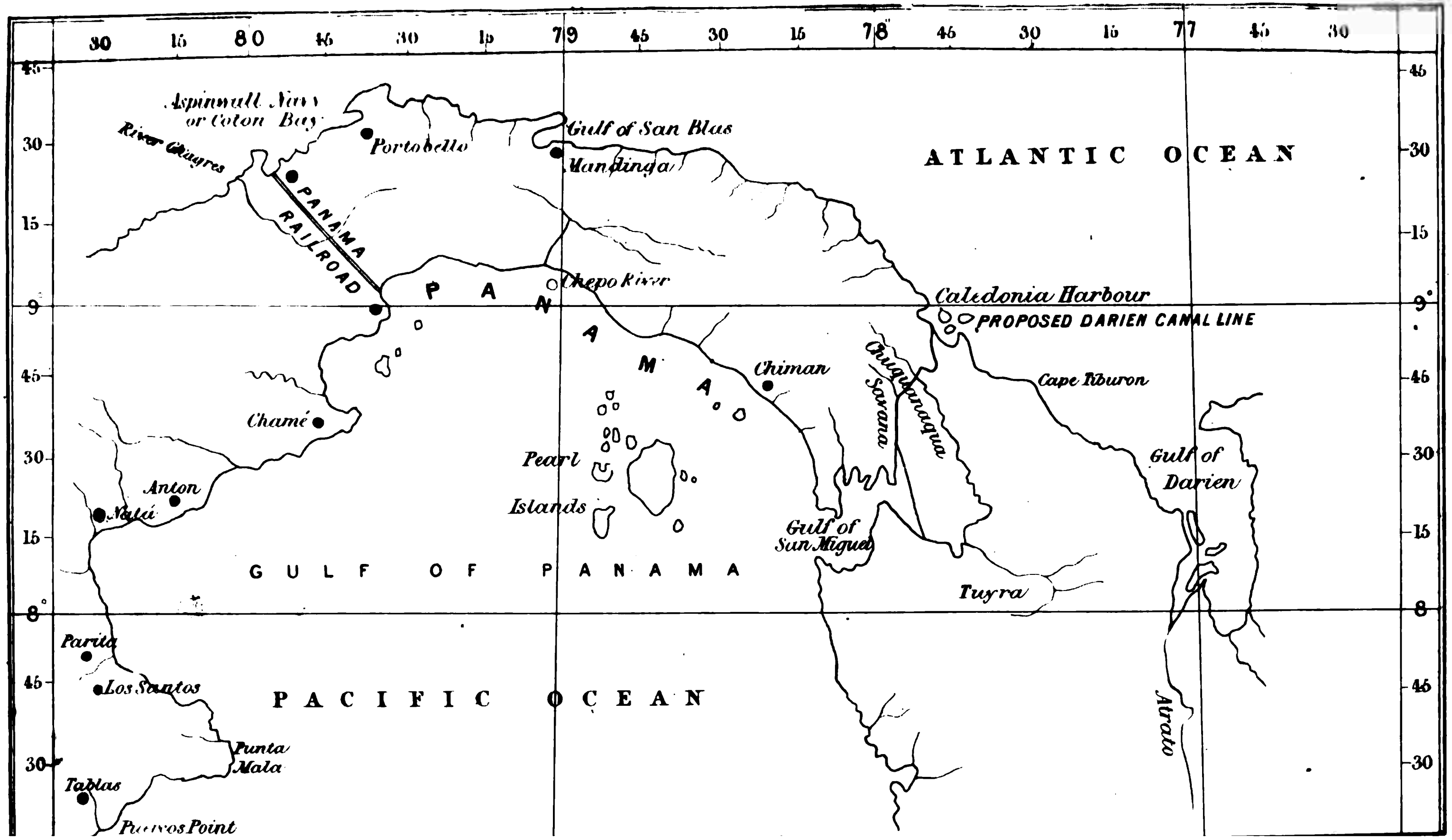
a Spot where the leaves were found.
b b Strata of slate-like coal.
c c Deep gorge, on the banks of which trunks of trees were found embedded.



SKETCH OF CLIFFS AT RITTENBENK'S KOLBRUND.

a Basalt.
b Yellowish sandstone, soft and disintegrated.
c Coal veins.

MAP OF THE ISTHMUS OF PANAMA



No. XXXVII.] [Price 2s.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

CONTENTS:

PAGE.
1. Mr. Kirby on the Diurnal Lepidoptera of the Extra-Tropical Northern Hemisphere, ... 163
2. Dr. De Ricci on the Culture of the Japanese Oak-feeding Silkworm, ... 172
3. Dr. Reynolds on a New Form of Spectroscope for Use in the Examination of Minerals, ... 178
4. Dr. Reynolds on the Estimation of Phosphoric Acid in Minerals and Agricultural Phosphates, ... 180
5. Mr. Sanders on the Construction of Meters for the Supply of Water, ... 183
6. Mr. Andrews on a Cetacean New to Ireland, ... 188
7. Mr. Andrews on certain Branches of Irish Industry, ... 192
8. Dr. Mann on the Physical Geography, Geology, and Mineralogy of the Colony of Natal, ... 206
9. Mr. Andrews on certain Woods and Timber Trees of New Zealand, ... 221
10. Dr. W. G. Smith on Black Wax, ... 227
11. Return of Donations to the Royal Dublin Society, ... 231
12. Intelligence:—
    - Dr. Moore's Botanical and Horticultural Notes, ... 241
    - Mr. W. F. Barrett on Musical and Sensitive Flames, ... 255
    - Dr. Carte and Dr. Reynolds' Report on Continental Museums, ... 260
    - School of Art, ... 268
    - Evening Meetings, ... 274

Appendix—Meteorological Journal from August, 1867, to March, 1868, . . . xxv

DUBLIN:
HODGES, SMITH, AND CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.
1868.

M. H. Gill, Printer to the Royal Dublin Society.

HARVARD COLLEGE
AUG 2 1917
LIBRARY

University

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

The Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Registrar:—

Life Membership, ...	£21 0 0
Annual Membership (with £3 3*s*. Entrance Fee),	2 2 0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15*s*.

I.—MEETINGS OF THE SOCIETY.

1. *Stated and Ordinary Meetings.*

The Society meets at 3 o'Clock P. M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday of November.

2. *Evening Scientific Meetings.*

Meetings of the Society, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5*s*. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6*d*. each; or to twelve for 5*s*., available for any of the ordinary Meetings throughout the Session.

THE COUNCIL AND COMMITTEES.

The Council meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

Six Standing Committees are annually elected, as follow s:—1. Agriculture 2. Botany; 3. Fine Arts; 4. Library; 5. Natural History; 6. Practical Science

[*For continuation, see page* 3 *of Cover*.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

XV.—*On the Diurnal Lepidoptera of the Extra-Tropical Northern Hemisphere.* By W. F. Kirby, Assistant in the Museum of the Royal Dublin Society.

[Read Nov. 18, 1867.]

Among all the subjects embraced in a scientific study of Natural History, the Geographical Distribution of animals and plants is one of the most interesting. I have paid a good deal of attention to it for a considerable period, and now propose to lay before this Society a few remarks on the distribution of butterflies. A few species are almost cosmopolitan; but generally we find a particular insect occurring in a definite locality, or at least in contiguous localities. Some idea may be formed of the influence of locality, from the fact that Corsican and Sardinian butterflies differ so remarkably from those of the mainland, that in many instances they are considered distinct species—even the caterpillars differing; while in Sicily we find some intermediate forms. Sicily appears not to have been isolated long enough to produce the Corsican forms; perhaps, at some future period, they may be evolved. We have not sufficient data at present to be entitled to speak conclusively on the possibility of Mr. Darwin's theory of the Origin of Species; but it seems probable, so far as our present knowledge goes, that it must in a great measure stand or fall by the facts of Geographical Distribution. The facts I have just mentioned with respect to Corsica seem alone sufficient to prove that an isolated race will in time diverge sufficiently from that of the main land to be considered as to all practical purposes a perfectly good and distinct species. The only question remaining is, whether there is any limit to such permanent variation; and to this I must again reply, that at present we have not sufficient data to speak positively. I cannot point to any *genera* peculiar to Corsica, though many species are so. The present remarks are merely intended to point out the philosophical bearings of the subject-matter of my paper; and perhaps at its conclusion some of the other naturalists present will be able to inform us how far the regions of the distribution of butterflies correspond with those of plants, birds, &c.

Owing to the divergence of the great continents in the South, and their continuity in the North, we find a Fauna tolerably uniform in appearance and character extending over the extra-tropical portions of Asia, Europe, the north coast of Africa, and the northern and western states of North America; while within the tropics, and south of the equator, the divergence is far greater, not only for the reason just mentioned, but also on account of the great natural barriers of mountains, deserts, and, perhaps, rivers. No one who has ever examined collections of Lepidoptera from Europe, Northern or Western Asia, or Northern or Western North America can have failed to notice the great similarity—amounting frequently to absolute identity—of species, and much more of type, in the productions of these widely separated regions. But on comparing collections from Europe, India, Africa south or east of the Sahara, and South America, we perceive at once that they belong to widely different regions, although a few species may be noticed common to two or more Faunas. I may here observe, however, that the Indo-Chinese Fauna, as it may be termed, impinges on the south-east of Europe, while in North China, North Japan, and Amoorland, it completely inosculates with that of Asia-Europe; a few American forms also occur near the north-east coast of Asia, just as we find a few Indian forms in Greece, Italy, and Austria. The insects of the Indian Archipelago and Australia are mainly of the Indian type. The Arabian Fauna is principally African in its character, while that of Persia and Syria is European—of course, with a larger admixture of truly Indian forms. The Fauna of the countries lying between India and Siberia is almost unknown, but appears to be chiefly European, and to abound in peculiar forms. It is remarkable that in many instances Asia-European genera reappear in Chili, while the butterflies of the Cape of Good Hope are, with scarcely an exception, entirely of an African type.

It is now agreed that there are only five great families of butterflies. This arrangement I shall adopt, and also avail myself of the use of sub-families; for though these divisions are mainly artificial, yet they are useful when applied to the productions of a limited district.

The first family, *Papilionidæ*, is subdivided into *Papilioninæ* and *Pierinæ*. The *Papilionidæ* are not numerous in our district; they are more characteristic of the various tropical Faunas. Although exceedingly numerous in species, they have not been satisfactorily divided into genera. The sub-family *Papilioninæ* may be divided into ten genera; but out of 533 species in Felder's Catalogue, 459 belong to the typical genus *Papilio* alone; and *Ornithoptera* and *Parnassius* are the only others that contain more than five species. Of these ten genera, *Papilio* is universally distributed; *Teinopalpus*, *Leptocircus*, *Atropha-*

neura, *Ornithoptera*, *Eurycus*, *Sericinus*, and *Mesapia* belong to the Indo-Chinese Fauna; *Euryades* to the South American Fauna, and the remainder to that of Asia-Europe; *Sericinus*, however, being confined to North China, may almost be considered as belonging to our district. Very few species of *Papilio* occur in the Northern temperate zone. The only British species is *P. Machaon*, principally found in the fens of the south-eastern counties of England. Of this group, two other species occur in Europe, and *P. Machaon* itself occurs throughout Europe, North Africa, the greater portion of Asia, and California. The North American species of *Papilio* which are similar to Old World types, are all related either to this group or that of *P. Podalirius*, a fourth European species. In Amoorland we find *P. Xuthulus*, a species intermediate between *P. Machaon* and *P. Xuthus*, a common Indian and Chinese species, which extends as far north as this district, where we also find two species of the group of *Papilio Paris*, a group exclusively Indian, and which does not occur at all in Western Asia-Europe, Africa, or America.

The small genera *Doritis* and *Thais* belong exclusively to the Mediterranean Fauna. The singular genus *Hypermnestra* appears to be confined to the Steppes of Western Asia, though it is likely that it may also occur within the limits of Europe. When Eastern and Southern Russia, and Turkey and Greece, are properly searched, many of the Western Asiatic and Syrian species will doubtless be added to the European list; and, in all probability, even a few more Indian ones. The genus *Parnassius* is one of those peculiarly characteristic of our district. The species inhabit mountains, and descend gradually to the plains as they advance north. The ascertained limits of the genus are the Sierra Nevada in Spain, the Caucasus, the Himalayas, and California. Its northern range is probably only limited by the Arctic Ocean; but the metropolis of the genus is in the high mountain ranges of Central Asia; and hence most of the species are extremely rare in collections. They are all very similar; white, more or less transparent, generally with black and red spots.

The European species of *Pieris* are divisible into several groups. The group represented by the common European *P. Cratægi* extends to Amoorland, and the Himalayas, and has also a representative in America. *P. Gliciria*, which is really an Indian species, occurs in Greece. A strongly marked variety of the common *P. Brassicæ*, or a closely allied species, is found in the Canaries, and *P. Melete*, a variety (?) of the Himalayan *P. Eruta*, occurs in Amoorland. The European species of *Pieris* are widely distributed throughout Northern Asia (*P. Daplidice* also occurs in India), and several allied species occur in North America. The typical groups of the genus *Anthocharis* are almost confined to our district; the numerous African species belonging to the group *Callosune*. Only two of the European species occur in North-Eastern Asia, and but one, allied to the European *A. tagis*, in India. The North American species mostly belong to a peculiar type, of which a new species from Japan has recently been described by

Mr. Butler, of the British Museum. The genus *Zegris* is confined to South Europe and South-Western Asia; and the few species or varieties of *Leucophasia* are scattered throughout Europe and North Asia without reaching North America. In the tropics the genus *Leucophasia* is replaced by *Pontia*. The genus *Colias* is very characteristic of the North. It is widely distributed, species occurring in South Africa, India, Buenos Ayres, and Chili; but in the tropics it is mostly replaced by *Callidryas*. Some of the species of *Colias* are polar, and it may be well to remark here that polar insects mostly occur all round the pole. A considerable number of species of this interesting but difficult genus occur in Europe, North Asia, and North America.

A few rather closely allied species of *Gonepteryx* occur in our district; and the common *G. Rhamni* is found in California. This insect has recently been taken in Ireland, where it had not been seen for twenty years previously. The genus *Idmais* includes several Indian and African species. One of the former, *I. Fausta*, occurs in Syria, and, not very improbably, also in Europe.

Six sub-families of *Nymphalidæ* occur in the district we are now considering. *Danais Chrysippus*, an abundant species in India and Africa, represents the *Danainæ* in South-Eastern Europe. The genus *Danais* is widely distributed; but its metropolis is certainly in India, China, and the Indian archipelago.

Only two genera of *Argynninæ* occur in Europe, Northern Asia, and Northern America. These are *Melitæa* and *Argynnis*. Both are wanting in Southern Africa, and the former in India. Several *Melitææ* occur in the tropics of the New World, but *Argynnis* is replaced there by *Agraulis* and other allied genera, reappearing however in Chili. The circumpolar species of *Argynnis*, of course, extend to America; and many European species are widely distributed in North Asia, along with species peculiar to that continent. In Amoorland we find, among others, the Chinese species *A. Sagana*, so remarkable for the disparity of the sexes, and *A. Ella*.* All the Indian species of *Argynnis* are confined to North India, except *A. Niphe*, a form not closely allied to any European species.

Of the next sub-family, *Vanessinæ*, we have five genera. The common European *Araschnia Prorsa* extends throughout Northern Asia; and in Amoorland, we find *A. Burejana*, a second species of this interesting genus. Mr. Butler has recently described a third from North Japan. The European species of *Grapta*, *Vanessa*, and *Pyrameis*, are widely distributed, some extending to India, and some to North America, in which countries, however, others are represented by allied species. *Pyrameis Cardui* is in fact almost cosmopolitan. *P. Callirhoe* replaces *P. Atalanta* in the Canaries, India, and Eastern Asia generally; but in Europe, North Africa, and North America, *P. Atalanta* alone occurs. In Amoorland we find the North American *Grapta Progne*, and the Indian and Chinese *Vanessa Charonia*. In India and Africa the genus *Vanessa* is mostly replaced by *Junonia*.

---

* The male of this species will be found described at the end of this paper. Only the female has been heretofore described.

The next sub-family, *Nymphalinæ*, is very poorly represented in Europe by three genera containing but five species; it is, however, very widely distributed, but belongs, properly speaking, to the Indo-Chinese Fauna; and the great genus *Neptis*, so numerous in Indian species, only sends two stragglers into Eastern Europe. Some of the Syrian species usually placed under *Limenitis* appear to be intermediate between this genus and *Neptis*. The Indian genus *Athyma* is represented by several species in Amoorland, and the genera *Diadema* and *Hestina* are probably represented there also. Several *Limenitis* and *Nymphalis* occur in North America, but in South America, the *Nymphalinæ* are represented by the genus *Heterochroa*. The *Apaturinæ* have only three representatives in Europe. The genus *Apatura* is widely distributed; while *Charaxes* belongs, properly speaking, to the Indian and African Faunas. An insect which Bremer considers an *Apatura*, and Herrich-Schäffer a *Euripus*, but which was originally described by Ménétriés under the name of *Adolias Schrenkii*, occurs in Amoorland. *Adolias* is a large Indo-Chinese genus. The *Satyrinæ* are extremely well represented in Europe, and several genera may be considered as almost confined to the European Fauna. It is owing to the great number of species of *Satyrinæ* and *Lycænidæ* that the European butterfly Fauna is so much richer than the North American and South African. The genera *Melanagria* and *Triphysa* seem to be confined to Europe and Northern and Western Asia; *Lasiommata*, or at least the typical groups, do not occur south of Teneriffe and the Himalayas; of *Hipparchia* and *Epinephile* the same may be said, and the small group of *Epinephile* represented in Britain by *E. Tithonus*, is exclusively confined to the south-west of Europe. The genus *Chionobas* is circumpolar in the northern hemisphere. *Cænonympha* and *Erebia*, though so numerous in species in Europe and North Asia, are badly represented elsewhere, though widely distributed, species occurring in almost every part of the world. The Indian genus *Yphthima* scarcely extends to Europe, though a few species occur in Northern and Western Asia; a few also in Africa.

The family *Erycinidæ* is very poorly represented in Europe and Northern Asia by a single species in each of two sub-families, *Libytheinæ* and *Erycininæ*. This family preponderates in South America, very few species occurring in any other part of the world.

The larger genera in the remaining sub-families *Lycænidæ* and *Hesperiidæ*, though some are very numerous in European and North Asian species, present little for special remark. The genera *Aurotis* and *Thestor* seem to belong to the Mediterranean Fauna; *Aphnæus* has two representatives in Syria; and the Indian genus *Amblypodia* occurs in Amoorland.

I append a table of the total number of butterflies, known on satisfactory authority, to occur in the different districts of Europe; but this is, necessarily, in some districts a very imperfect summary.

TABLE I.

Sub-families and Families.	Europe.	Iceland.	Scand.	N. Russ.	S. Russ.	Turkey, Greece, & Dalm.
Papilionidæ :—						
Papilioninæ,	12	...	4	4	7	6
Pierinæ,	37	3	11	13	22	16
Nymphalidæ :—						
Danainæ,	1	...	...	...	...	1
Argynninæ,	41	1	23	23	30	13
Vanessinæ,	11	...	7	10	11	5
Nymphalinæ,	5	...	1	3	5	4
Apaturinæ,	3	...	...	2	2	1
Satyrinæ,	100	2	24	20	53	27
Erycinidæ :—						
Libytheinæ,	1	...	...	...	1	1
Erycininæ,	1	...	1	...	...	...
Lycænidæ,	80	...	31	26	57	37
Hesperiidæ,	31	...	11	12	22	12
Total	323	6	113	113	210	123

Sub-families and Families.	Italy.	Corsica and Sardinia	Spain.	France.	Great Britain.	Ireland.	Prussia, Germ., Netherl., & Denm.	Austria and Switzerland.
Papilionidæ :—								
Papilioninæ,	9	4	6	8	1	..	4	7
Pierinæ,	18	10	17	20	10	9	12	18
Nymphalidæ :—								
Danainæ,	1	...	...	...	...	...	...	...
Argynninæ,	28	4	14	24	9	5	27	28
Vanessinæ,	10	7	7	9	7	6	10	11
Nymphalinæ,	4	1	1	3	1	...	3	5
Apaturinæ,	2	...	1	3	1	...	2	2
Satyrinæ,	49	17	27	59	11	9	33	62
Erycinidæ :—								
Libytheinæ,	1	1	1	1	..	...	...	1
Erycininæ,	1	...	...	1	1	1	1	1
Lycænidæ,	52	17	29	4	16	10	41	50
Hesperiidæ,	21	9	19	20	7	4	17	21
Total	196	70	122	202	64	44	150	206

At a rough estimate, we may set down the number of species in Europe and Siberia at 400; in Amoorland at 160; in the northern and western states of North America at 300; in South Africa at 230; in India at 600, and in the Amazon Valley of South America (by far the richest district in the world for butterflies) at 2000.

Various divisions have been mapped out by naturalists who have written on Geographical Distribution; but that ordinarily used in England is that of Dr. Sclater. He divides the world into six provinces, as follows:—1. Neotropical; 2. Nearctic; 3. Palæarctic; 4. Ethiopian; 5. Indian; 6. Australian. In the present paper I have occupied myself with Nos. 2 and 3 only. Dr. Sclater's Palæarctic Region, however, extends as far as Thibet in the south, embracing a portion of the Himalayas, and the greater portion of Northern and Central China. It was unnecessary for my present purpose to include China.

TABLE II.,

Showing the distribution of Northern Genera in Europe, Siberia, and the Mediterranean Basin, Amoorland, and part of Japan, North and West America, South Africa, India, and South America.

Genera.	Northern Faunas.			Southern Faunas.		
	Europe, &c.	Amoorland, &c.	N. & W. America	South America	South Africa.	India.
Papilio:—						
Machaon Group,	*	*	*	..	..	*
Podalirius Group,	*	..	*	*	..	..
Paris Group,	..	*	..	..	..	*
Other Groups,	..	..	*	*	*	*
Thais,	*	..	..	..	..	..
Doritis,	*	..	..	..	..	..
Hypermnestra,	*	..	..	..	..	..
Parnassius,	*	*	*	..	..	*
Leucophasia,	*	*	..	..	..	..
Terias,	..	..	*	*	*	*
Pieris:—						
Cratægi Group,	*	*	*	*	..	*
Brassicæ Group,	*	*	*	?	..	*
Mesentina Group,	*	..	..	?	*	*
Other Groups,	*	*	*	*	*	*
Zegris,	*	..	..	..	..	..
Anthocharis:—						
Genutia Group,	..	*	*	..	..	..
Other Groups,	*	*	*	*	..	*
Nathalis,	..	..	*	*	..	..
Colias,	*	*	*	*	*	*
Idmais,	*	..	..	..	*	*
Gonepteryx,	*	*	*	..	..	*
Callidryas,	..	..	*	*	*	*
Danais,	*	..	*	*	*	*
Melitæa,	*	*	*	*	..	..

Genera.	Northern Faunas.			Southern Faunas.		
	Europe, &c.	Amoorland, &c	N. & W. America	South America	South Africa.	India.
Argynnis:—						
Selene Group,	*	*	*	*	..	..
Other Groups,	*	*	*	..	..	*
Araschnia,	*	*	..	..	..	..
Grapta,	*	*	*	?	..	*
Vanessa,	*	*	*	..	..	*
Pyrameis,	*	*	*	*	*	*
Neptis,	*	*	..	..	*	*
Athyma,	..	*	..	..	*	*
Limenitis,	*	*	..	..	..	*
Diadema,	..	?	..	..	*	*
Hestina,	..	?	..	..	..	*
Euripus,	..	?	..	..	..	*
Adolias,	..	?	..	..	..	*
Apatura,	*	*	*	*	..	*
Charaxes,	*	..	..	..	*	*
Melanagria,	*	*	..	..	..	..
Lasiommata,	*	*	..	..	..	*
Hipparchia,	*	*	*	*	..	*
Epinephile,	*	*	*	*	..	*
Triphysa,	*	*	..	..	..	..
Cœnonympha,	*	*	*	..	..	..
Yphthima,	*	*	..	..	*	*
Chionobas,	*	*	*	*	..	..
Erebia,	*	*	*	?	*	*
Euptychia,	..	..	*	*	..	..
Pronophila,	..	?	..	*	..	*
Debis,	..	*	*	..	*	*
Neope,	..	*	..	..	..	*
Libythea,	*	..	..	..	?	..
Nemeobius,	*	..	..	..	..	*
Amblypodia,	..	*	..	..	*	*
Dipsas,	*	*	..	..	..	*
Thecla,	*	*	*	*	..	..
Aurotis,	*	..	..	..	..	..
Thestor,	*	..	..	..	..	*
Aphnæus,	*	..	..	..	*	*
Chrysophanus,	*	*	*	..	*	*
Lycæna,	*	*	*	*	*	*
Pyrgus,	*	*	*	*	*	*
Nisoniades,	*	*	*	..	*	*
Pamphila,	*	*	*	..	*	*
Cyclopides,	*	*	*	..	*	..
Goniuris,	..	*	*	*	..	..
Goniloba,	..	..	*	*	..	*

It must be remembered that though most of the European genera (with many others) occur in India, very few species are common to both countries.

ARGYNNIS ELLA, BREMER.

This species was described and figured in Bremer's "Lepidopteren Ost-Sibiriens," p. 94, n. 11, pl. 8, f. 1, from a unique female example taken near Port Mai. The Society possesses a pair of this species from Japan, presented by Captain Boxer, and I therefore give here Bremer's diagnosis, and a translation of his description, and remarks on the species, appending thereto a relative description of the male, taken from the example in the Society's Museum.

Alæ anticæ sinuatæ, posticæ dentatæ, omnes fulvæ nigro-maculatæ, anticæ macula triangulari, apicem versus, ad marginem anteriorem.

"*Alæ anticæ subtus pallide fulvæ maculis ordinariis cellulæ medianæ maculisque* 9 *nigris ; apice viridi-micanti, albido-irrorato, maculam albam paginæ superioris includente—alæ posticæ viridescenti-micantæ seriebus tribus macularum obscuriorum ; maculis seriei internæ albo-pupillatis, seriei submarginalis rotundatis serieique marginalis lunulatis ; macula ad marginem anteriorem alba.* 79 m.

"Larger than any European species of *Argynnis*. Fore-wings with the hind margin very strongly indented. Upperside of the wings spotted as in *Laodice*, with a white spot near the tip of the fore-wings, as in the female of *Laodice*.* Underside paler ; the usual markings in the middle of the cells, as in *Paphia ;* on the outside of these cells are two black blotches in cells 2 and 5, followed by a row of black blotches in cells, 1, 2, 3, 4, 5, 6, and 9. This row of blotches makes a right angle in cell 3, and the spots become smaller as they approach the costa. The tips of the wings are varied with greenish, dusted with whitish atoms slightly inclining to reddish, and with the triangular white spot of the fore-wings indicated.

"[Underside of] hind-wings varied with unicolorous pale green, a white crescent-shaped mark on the costa, followed by a row of rather darker rounder and greener spots with white pupils; beyond this is a similar row without white pupils ; a third row of crescent-shaped spots scarcely defined from the ground colour precedes the hind-margin.

"Only the upper side of our species resembles *Laodice* in the position of the markings ; the lower side of the wings, independently of their contour, is remarkably dissimilar in colour and pattern ; probably the fore-wings of the male, which is at present unknown, may be still more strongly curved. Only one female specimen taken at Port Mai on the 26th of August."

I will add here that our specimen of the female is duller coloured, and more suffused with greenish brown towards the tips of the fore-wings above than represented in Bremer's figure; the spots are also larger, and generally rounder. Our specimen of the male differs from the female in being slightly more rounded at the tips of the fore-wings.

---

* Traces of this spot may also be observed on the underside of the fore-wing of the female of *A. Paphia*.—W. F. K.

The emargination is hardly more noticeable in one sex than in the other. Contrary to Bremer's expectation, the emargination is, if anything, less conspicuous in the male. This sex has no trace of the white spot, or of the dark apical shading. The tint and markings of the fore-wings of the male, (the veins of which are not incrassated) are almost identical with those of the Indian *A. Niphe* male, except that the double row of marginal spots runs nearly straight from the inner margin to the costa, and these spots decrease uniformly in size from the spot second from the inner margin, to the costa. The black spot between the second row of marginal spots and the angulated branch is also wanting in *A. Ella*. The spots nearer the base are also larger than in *A. Niphe* male. The hind wings in *A. Ella* are nearly similar in both sexes; there are 3 marginal rows of black spots; and the cell is surrounded with five other spots, and contains a sixth. But the costal spot of the second marginal row is only present in the male. The underside of the fore-wings in the male is unicolorous pale fulvous, very slightly greenish towards the tip; in our example of the female, the apical greenish portion of the wing is much more extended than in Bremer's figure, and the white spot is surrounded with a slight whitish violet tint, and there is a rather large irregular square blotch of a similar colour between this and the tip. The hind-wings beneath do not differ from his figure except in being much less distinctly spotted. The under side of the hind-wings in the male are of a much more brassy green than in the female, and the markings are still more indistinct. The most conspicuous markings on the underside of the hind-wings in both sexes are a silvery streak along the costa (narrower in our specimens than in Bremer's figure), which meets a triangular silvery spot, at about the same point as the commencement of the chief silvery band in *A. Paphia.*

XVI.—*On the Culture of the Japanese Oak-feeding Silkworm, Bombyx Yama-maï.* By HERMANN ROBERT DE RICCI, M. D.

[Read Monday November 18, 1867.]

I WISH to lay before the Royal Dublin Society the results of an attempt made during the past summer to introduce into Ireland the culture of the Japanese silkworm, *Bombyx Yama-maï.* It is impossible to infer from one small experiment whether the culture of this silkworm will succeed as a practical undertaking in this island; but from the results obtained, and from the similarity of the Irish climate to the Japanese, I am inclined to believe that this silkworm will be easily acclimatized in this country, and that within a comparatively short period of time the culture of the oak-feeding silkworms will be added to the already existing industries of this country.

It had been known to naturalists ever since the return to Europe, at the end of the last century, of the celebrated physician, Thunberg, who lived at the court of the Emperor of Japan for fourteen years, that the most precious silks of that distant and mysterious country were the produce of a different silkworm from the Chinese *Bombyx mori*, which is the insect that for hundreds of years has supplied with silk all the nations of the civilized world; but Japan being in those days absolutely inaccessible to Europeans, because, although the Dutch were allowed to have a small trading factory at Nangasaki, still they were only tolerated there as a kind of prisoners, and never allowed to proceed outside the palisades of their own factory, we could only obtain vague and unsatisfactory accounts of the riches, resources, and industries of that wonderful country. A new state of things was, however, initiated a few years ago—the western nations, determined upon throwing open the commerce of that distant island, expeditions were fitted out, commercial treaties were stipulated, seaports were thrown open, mutual relations were established, and at present there is as little difficulty in trading with Japan as with any other country. About the very time that the western nations were thus opening up the resources of Japan to the enterprise of all the world, a destructive disease made its appearance among the silkworms of Italy and France, and ruin to thousands followed in its wake. So terrible were deemed the consequences of this distemper, and so important was the culture of silkworms to these countries, that special commissioners were despatched by the Governments of Italy and France to visit the silkworm districts of China, and from thence obtain fresh supplies of the eggs of the *Bombyx mori* in hopes that a fresh importation from the countries in which this insect was indigenous might prove sufficiently hardy to withstand the ravages of the disease which was destroying them in Europe. This experiment succeeded in part, the disease having attacked even the newly imported worm, though in a less degree. It was then that the Emperor of the French, with his characteristic sagacity, despatched a commissioner to Japan to inquire into the agricultural resources of that country generally, but specially with reference to those silkworms which did not feed on the mulberry, and which were known to exist both in China and in Japan.

It would delay the Society too long were I to enter into the full account of how the *Bombyx Cynthia*, which feeds on the Chinese Aïlanthus, was introduced, and is at present so ably cultivated on a large scale in England by Dr. Wallace, of Colchester, of the *Bombyx Pernii*, that feeds on the oak in the north of China, of that variety of *Bombyx Cynthia* which feeds on the castor-oil plant in India, or of all those different kinds which the ingenuity of entomologists suggested as likely to be utilized, and which have been tried with considerable success in Algeria and in North America; and I shall confine myself solely to the one species, the *Bombyx Yama-maï*. The French commissioner, having arrived at Yokohama, was received with all the characteristic courtesy of the Japanese officials, and obtained all the information he desired about the oak-feeding silkworms; but when he came to ask for a supply of eggs to transmit to his master, the

Emperor of the French, he was told that it was simply *impossible;* that these silkworms, called in Japan *Yama-maï*, were the exclusive property of the Taicoon, were grown solely in two provinces, strictly guarded, and that any one found removing a single worm or a single egg would be punished with death—that the happy dispatch awaited any one who would be rash enough to enter on such a venture! The French commissioner, nothing daunted, tried again, and this time officially through the ambassador and the naval commander, but failed again. The commissioner then tried what could be done by subtlety, and endeavoured to obtain his end by bribing some of the native merchants, and here he was again baffled: some of the natives flatly refusing to entertain his proposal, while others supplied him with imitation eggs, made of papier mache; and at the end of his mission he had to return to Europe, without a single real egg of the *Bombyx Yama-maï*.

This was a serious disappointment to those who took an interest in silk culture, and it was determined to make another attempt to obtain the eggs of this apparently most valuable silkworm. The Dutch Government, having for many years been on terms of friendship with the Japanese Government, it was thought wise to obtain its co-operation in this new tentative; and through it an order was obtained, and sent to Dr. Pompe Van Meerde Voort, Director-in-chief of the Medical School at Nangasaki, in Japan. He at once entered with spirit into the adventure; and through one of his medical pupils, who risked his life to oblige his master, Dr. P. Van M., obtained a supply of eggs of the much coveted silkworm. With these the Dr. started at once for Europe, and succeeded in bringing a few of the eggs in good condition, but only very few; because, in consequence of the heat in the tropics, and to prevent the eggs from hatching during the voyage, they had to be kept during the journey in the ice store of the ship, and thus many eggs were lost by exposure to excessive cold. On their arrival in Europe, the eggs were divided between a few of the best known silkworm growers of France, Italy, and Germany, who raised worms from them with different degrees of success, and sent in their reports of their first attempt at cultivating the *Yama-maï* to the Imperial Society of Acclimatization of Paris. This first attempt was made in 1863.

Having heard of these results in France, and having casually been informed by a friend who had travelled much in Japan, that the climate of that country was very similar to ours, and having also considered that the plants of Japan all grew freely and luxuriantly in this country, I turned my attention seriously to the subject, and set about obtaining eggs of *Yama-maï*. At this time Dr. Wallace, of Colchester, was making vigorous efforts at establishing the culture of the Aïlanthus worm in England, a culture which has succeeded very well, and which he is now carrying out on a large scale. I completely failed in obtaining *Yama-maï* eggs the first year I tried. I wrote to Paris to the Society of Acclimatization, I wrote to private friends, but all to no purpose, the eggs were too scarce; I was, however, promised a few for the following year, 1867. I might have got plenty of Aïlanthus eggs from Lady Dorothy Neville, but I did not want to grow that species; I wanted the oak-feeding worms, and not the *Bombyx Cynthia*, for the following reasons:—I argued, first, that the *Aïlanthus Glandulosa*, although pretty hardy in Ireland, is not an indigenous plant, whereas the oak is essentially an Irish tree; that the *Aïlanthus* has had to be acclimatized, and that naturally an insect feeding on it would prove, in all probability, less hardy than one intended by nature to feed on the oak. The *Aïlanthus* plantations would have still to be made, while thousands of acres of oak are in readiness wherewith to feed thousands of millions of *Yama-mai*. The climate of Ireland was also in favour of the latter; for, while the Aïlanthus worm delights in a dry, sunny clime, the oak worms love a variable climate, and do not thrive unless exposed to frequent showers. I therefore came to the conclusion that, if any silkworm should ever be successfully introduced into this country for commercial purposes, it should be the Japanese oak-feeding worm; for, if the oak is the native tree of Ireland, the insect destined by Providence to find its sustenance on the oak should be easily naturalized.

One year's experiment can naturally throw but little light on this question, but I have very little doubt that in a few years the value of this silkworm will be so throughly recognized that its cultivation through Wicklow and the south of Ireland will be carried on on a large and remunerative scale. The oaks are there, and grow without care or culture in the poorest soil or on the rockiest and bleakest hills, where nothing else will grow. Three months is all the time which at furthest is required to rear a colony of worms; little or no manual labour is required, so that none but young girls and children, under the superintendence of one intelligent person, need be told off for such duty.

At present, and for some years to come, it might probably be necessary to cultivate these silkworms in the open air, and considerable loss would be thus inevitably sustained, by birds, who would pick them off, wasps, and ichneumons; but I believe that in a comparatively short time, by care and selection in rearing these worms, an improved variety could with facility be obtained, which having lost its wild, rambling propensities, and acquired modified instincts, would, like the silkworm of the mulberry, live, propagate in-doors, and feed like it on gathered oak leaves; for we must not forget that the ordinary mulberry silkworms that in Italy and France are now so easily reared in houses, on picked leaves, feed on the trees in the open air in some parts of China; but the cocoons of these wild Chinese mulberry worms are much inferior in size, form, quality and quantity, to the best Italian and French cocoons, and this improvement has entirely been brought about by a strict system of selection practised for some hundreds of years. What, therefore, has succeeded, with the *Bombyx mori* will, I expect, succeed with our Japanese silk-worm; and we must not be deterred by the prospect of many years having to elapse before a fully improved variety shall be obtained: those that sow the acorns seldom live to cut down the full-grown oak; still hundreds of wise proprietors follow the advice of Dumby Dykes to his son:—"Jock, when ye hae naething else to do, ye may be aye sticking in a tree; it will be growing, Jock, when ye're sleeping."

I regret extremely that I am unable to lay this evening before the Royal Dublin Society a collection of silk cocoons as well as samples of raw and spun silk of different species of silk-producing worms, and especially of the species under consideration, which I obtained at Paris last summer, at the Universal Exposition, through the kindness of my friend, Dr. Soubeiran, the Secretary of the Imperial Society of Acclimatization. I had hoped that this collection would have reached me in time for this evening, but unfortunately I have been disappointed, and I can only exhibit to you a few cocoons of the *Bombyx Yama-mai*, which I succeeded in rearing last summer, from a few eggs which I obtained from France with great difficulty, as the culture of this silkworm had almost universally failed in the previous year, 1866. I received two supplies of eggs in March, 1867, from different sources, and placed them in a cool dry cellar, and endeavoured to prevent them from hatching until the oak should be in leaf, but on the 4th of April, while yet the oak buds were unopened, and the temperature of the cellar only 54°, the worms began to come out. I at once cut off some branches of the early Turkey Oak, and plunged them in the tan bed of a hot-house, to force them quickly into leaf, and in the mean time offered my worms some young leaves of the Japanese quince, in hopes they might eat it, as it came from their own country; neither was I disappointed—the worms evidently did not enjoy the *Pyrus Japonica* as much as the oak, but they fed on it for a few days. I happened about this time to go to Wicklow, and there I learned from my friend. Mr. Tighe of Rossana, that there was *one* oak in his demesne which was always in leaf one month before any other oak in the country, and this oak eventually saved the life of my entire brood. I found no difficulty in rearing the worms; I supplied them with fresh twigs of oak every day, which were kept fresh by being plunged in jars of water. Having learned that in Japan they were constantly exposed to showers, I tried artificial rain over them, and was soon convinced of its importance, as the worms, when exposed to it, became much more lively, and seemed to eat with more avidity than when the leaves were dry. I was very successful with these worms, I did not lose more than 15 per cent. from the day of their birth till their last moulting, when having been obliged, on account of my health, to go abroad, I had to leave the care of them to another person, and during my absence of five weeks, of 64 worms which I left in perfect health only six arrived at spinning their cocoons; all the rest died! Still I was more successful than Dr. Wallace of Colchester, who did not save even *one* of his, and I have no doubt that after a time, when we shall be better acquainted with the peculiarities of these worms, and their requirements, we shall be as successful in Ireland as in Japan. The *Bombyx Yama-maï* is the insect appointed by nature to feed on the oak; the oak is the natural indigenous tree of this island, and I firmly believe that with care, patience, and perseverance, it will be feasible to establish in this country, the cultivation of this important silkworm, and thus create a new branch of industry—a new source of wealth.

The Chairman (Mr. **William Andrews**) observed upon the paper generally, and expressed himself convinced of the importance and feasibility of introducing the culture of the oak-feeding silkworm into Ireland.

Mr. James Haughton asked if a large quantity of silk from this insect was produced in Japan, and whether the moth was prolific in depositing her eggs.

Mr. Waldron (Secretary) observed that M. Personnat was the most successful cultivator of oak-feeding silkworms in France. The difficulty he had chiefly to contend with was the hatching of the eggs before the oak had put out its leaves. He (Mr. Waldron) had made several inquiries as to the cultivation of this insect, and he felt convinced that the turning point of success was the acquisition of an early leafing oak.

Mr. Amos Vereker suggested that, probably, some other food might be found for the newly hatched catterpillars, by which they might be sustained until oak leaves could be procured; and he mentioned, by way of analogy, that mulberry-feeding silkworms, when young, will eat lettuce leaves, but that once they taste the mulberry they will not eat the lettuce.

Mr. W. F. Kirby asked Dr. De Ricci in what way he supplied moisture for the caterpillars; and mentioned that Mr. Gascoyne, who had been very successful in the cultivation of the insect, stated that he did not supply them with water.

Dr. J. Emerson Reynolds stated that the ordinary silk was soluble in a solution of chloride of zinc—a property which rendered it easy to detect in fabrics the presence of any other fibre. He thought it would be desirable to ascertain if the silk of the oak-feeding insect were also soluble in chloride of zinc.

Mr. A. G. More suggested, with reference to the tendency of the eggs of the oak-feeding silkworm to hatch before the leafing of the oak, that their hatching might be delayed by keeping the eggs in a cool place.

Mr. **Waldron** stated that he feared in that case the eggs would probably be killed.

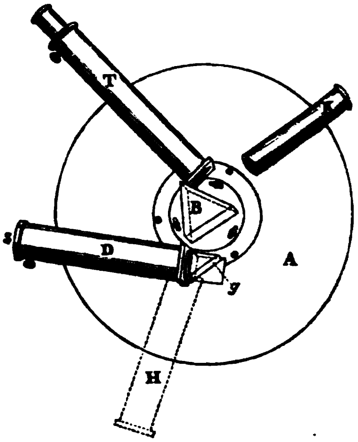
Dr. De Ricci, in reference to several points raised in the discussion, stated that the *Bombyx Yama-mai* lays fewer eggs than the mulberry silkworm. He stated that he was aware of the existence of an early leafing oak—a variety of the *Q. sessiliflora*—at Rossana, which it would be, no doubt, desirable to propagate for this purpose by cuttings. Having observed the fact that some of the eggs of the *Yama-mai* had not hatched until May, he was of opinion that by carefully selecting the eggs produced by the late hatched insect, a race of late hatchers might by degrees be obtained. He thought the watering of the insects by fine spray was essential to the success of their cultivation. The insects obtained must be looked upon as in their wild state, which it would take several generations to acclimatize. It should be ever remembered that the mulberry silkworm took centuries to come into cultivation.

XVII.—*A New Form of Spectroscope for Use in the Examination of Minerals.* By DR. J. EMERSON REYNOLDS, Keeper of Minerals, Royal Dublin Society.

[Read December 16, 1867.]

THE modified Spectroscope presently to be described was arranged some time ago by me, for the purpose of supplying a deficiency long felt in using the ordinary form of spectrum apparatus.

I believe all who have much employed the delicate and beautiful mode of investigation afforded by the method of spectrum analysis, will agree with me that the ordinary single prism arrangement is by no means well suited for use in the routine work of a chemical laboratory. When the eye of the operator is applied to the telescope of the instrument, the slit and the flame in which the test specimen is being ignited are out of view, and beyond easy control. Practice will, of course, overcome much of the difficulty attendant upon this circumstance; but for rapid and satisfactory work it is always necessary to obtain the aid of an assistant. The same objection applies with equal force to the direct vision Spectroscope of M. Hoffman, excellent though this instrument is in other respects. Every chemist knows how advantageous it is to have his apparatus entirely under his own control; hence I set to work to remedy the defect above referred to, and have succeeded in arranging the Spectroscope so as to admit of its use in ordinary analysis with great facility and comfort to the operator.



The accompanying woodcut represents the Spectroscope as seen from above.

A is a circular table of brass, surmounting a pillar and heavy foot, not shown in the drawing. In the centre of the table, and on a raised metal disc, the prism *B* is fixed securely, but the small carrier plate admits of slight rotation round its centre, in order that the adjustment of the prism may be easily effected; the latter is a glass cell, filled with bisulphide of carbon, the refracting angle being 59°. The tube *D* is fitted to the table, and carries at one end the slit *S* and adjusting screw, and at the other the collimating lens. On a little stage is fixed the reflecting prism *g*, the use of which will presently be shown. *T* is the observing telescope, which has a magnifying power of about 8; this tube is carried by a stout arm, which latter permits considerable angular motion of the telescope. *K* is a short tube, also moveable round the centre of the table; at one end of the tube is placed a photographed scale, and at the other a lens, with the scale in its principal focus.

In using this instrument, light from any source, after passing through the slit *S* and the plano-convex lens, instead of being allowed to fall directly on the first face of B, as in the ordinary instrument, is reflected at a right angle to its first path by means of the little prism *g*, and then passes through the prism *B*, suffering refraction and dispersion; the spectrum so produced is then observed with the telescope *T*. In accurate experiments of course, it is necessary to measure the distances which intervene between the lines produced by any flame under examination; this is easily effected by adjusting the tube *K*, and when a candle is placed behind the photographed scale a bright image of the latter is thrown into the telescope *T* by reflection from the second face of *B*. When in use, the instrument is covered with a japanned tin cap, blackened inside, with slits cut in the sides to admit of the passage of the tubes *D*, *T*, and *K*; by this means all extraneous light is prevented reaching the instrument.

The point of novelty in this Spectroscope is, in addition to some minor mechanical details, the reflection, by means of the prism *g*, of the bundle of rays transmitted by the slit at right angles to their former path, with a minimum loss of light, and without the annoyance of secondary spectrum. The advantage gained is an important practical one. While using but one prism for dispersion, the eyepiece of the observing telescope and the slit *S* are brought close together, so that the analyst having his eye at the former, still has the slit, the gas flame, and the platinum wire carrying the substance to be examined, perfectly under his own control. The position of the slit in the ordinary instruments is shown by the dotted lines H, in which case it is scarcely within easy reach if the apparatus be of large size.

By thus increasing the facility with which the Spectroscope may be used in the examination of minerals, I hope it may induce many mineral chemists to employ it in their investigations, and thus render their observations on the constituents of minerals more accurate, and in every way satisfactory.

I may conclude with a few hints as to the method which experience has shown me is most satisfactory in testing minerals with the Spectroscope, when the colourless flame of the Bunsen burner is used as the source of heat:—

1. Moisten the finely powered mineral with pure water, take up some of the paste on a loop of platinum wire, and slowly introduce into the flame, observing the spectrum produced, if any.

2. Moisten the same portion, or a fresh quantity, if the first be lost, with a drop of pure hydrochloric acid; again subject the test specimen to the heat of the flame, and observe. Most silicates yield up their bases easily by this treatment.

3. To the same test add a drop of a mixture of hydrofluoric and hydrochloric acids, allow the liquid to act for a few minutes, and then heat as before.

By adopting this systematic treatment, no substance which gives a characteristic spectrum under these circumstances can escape detection; and if the three tests be applied to the same specimen, the first one, by causing the volatilisation of the greater part of the most volatile constituents, renders the succeeding stages more clear and precise.

Finally, in examining sulphides, it is necessary to heat a portion of the substance in a small closed tube; in the sulphur sublimate thallum is easily detected, if it be present in the ore, and the residue needs but to be moistened with hydrochloric acid, and heated, for the detection of the presence of such metals as admit of easy recognition by the method of spectrum analysis.

XVIII.—*Note on the Estimation of Phosphoric Acid in Minerals and Agricultural Phosphates.* By Dr. J. Emerson Reynolds, Keeper of the Minerals, Royal Dublin Society.

[Read January 20th, 1868.]

In estimating the amount of phosphoric acid in many minerals and agricultural phosphates, it is usually of importance to make the necessary determinations not only with great accuracy, but also with rapidity; this is especially desirable in commercial analyses, as the intending purchaser of the mineral or manure often waits for the report of the chemist before concluding his bargain with the vendor.

Many processes have been proposed from time to time for the determination of phosphoric acid, both by the gravimetric and volumetric methods. My own experience of these may be summed up by saying that the former are generally accurate, but tedious, and the latter rapid, but untrustworthy, except under peculiar circumstances. We are, however, indebted to the distinguished French chemist, M. Chancel,* for a suggestion which is of considerable practical importance, and one which I regret to find has not attracted the attention which it deserves. M. Chancel proposes to determine phosphoric acid as the phosphate of bismuth, and in addition to other advantages which we shall presently find this process to possess, it enjoys the very important ones of being rapid and easy of execution, while affording results of a very high degree of accuracy. During the last four years I have employed this method occasionally, and have lately specially determined its capabilities in reference to the analyses of agricultural phosphates, and the results of this detailed examination of the bismuth process I may now proceed to lay before the Society, as I believe the extensive chemical laboratory of such an institution as this can be of real service to science, not only in affording facilities for original research, but also in the more humble work of testing methods of analysis, and determining the degree of reliance which may be placed upon the results obtained by their aid.

---

* Comptes Rendus, t. L., p. 417.

The bismuth solution used as a precipitant requires to be prepared with some care, as we are all familiar with the tendency which the salts of this metal have to suffer decomposition by dilution with water. Any difficulty in this respect is easily avoided by paying attention to the following directions:—Dissolve 30 grammes of the "subnitrate of bismuth" of the shops in 120 cubic centimetres of pure nitric acid sp. gr. 1.35, with the aid of a gentle heat, then pour in 900 c. c. of distilled water, boil the mixture for ten minutes, and filter if necessary. This is the precipitating solution, and should bear dilution with a large volume of water without the production of any turbidity even on boiling.

In a solution containing phosphoric and nitric acids, with the alkalies or alkaline earths, it is only necessary to heat the liquid to boiling, first having ascertained that there is no great excess of nitric acid present, then add a sufficient quantity of the bismuth solution, boil for a short time, filter and wash with hot water until the filtrate ceases to alter blue litmus paper. The filter is dried in an air bath, the precipitate then detached, and the paper burnt separately, the ashes being added to the precipitate and the whole ignited for a few minutes, and then weighed. The residue is pure phosphate of bismuth, the proportion of phosphoric acid in which can be calculated from the following:—

Phosphoric acid, ...	23.28
Trioxide of Bismuth, ...	76.72
$Bi''' PO_4$ =	100.00

The factor for the phosphoric acid in this precipitate is obviously 23.28.

The following test determinations, amongst others, were made with a solution of pure phosphate of sodium containing .007102 grammes of $P_2 O_5$ in each cubic centimetre.

1. 50 c. c. of phosphate of sodium solution were diluted with water and precipitated with excess of bismuth solution at a boiling temperature, when washed, dried, ignited and weighed, gave of phosphate of bismuth precipitate = 1.518 grms.

2. 50 c. c. with a moderate excess of pure nitric acid gave, on precipitation with bismuth, a precipitate of phosphate of bismuth weighing = 1.516 grms.

3. 50 c. c phosphate solution with the addition of considerable excess of citric acid, treated with bismuth solution, and allowed to stand for 24 hours, gave = 1.52 grms. of phosphate of bismuth.

4. 50 c. c. in presence of a large quantity of alumina, when treated in the ordinary way, gave phosphate of bismuth = 1.516 grms.

The mean of these determinations under such varied conditions give 1.5175 of phosphate of bismuth produced by 50 c. c. of the solution of phosphate of sodium; this corresponds to .35327 grms. of $P_2 O_5$ the 50 c. c. of phosphate of sodium solution having previously been found to contain .3551 grms. of $P_2 O_5$.

These and similar determinations under other conditions were most satisfactory. More need not be said upon this head. We now come to another and important branch of this subject; I refer to the precautions to be adopted in using this method.

The bismuth process gives very inaccurate results if it be attempted to estimate phosphoric acid by its aid in solutions containing sulphuric or hydrochloric acids, or ammoniacal salts. These bodies must, therefore, be removed from the solution prior to the precipitation by bismuth. The sulphuric and hydrochloric acids are easily separated by nitrate of barium and nitrate of silver respectively, an excess of either precipitant being of no importance in the succeeding steps of the process. Ammonia is driven off by boiling with a little pure hydrate of potassium; the liquid is then acidified with nitric acid, and the determination made in the ordinary way. These are the only substances likely to be met with in the ordinary course of analysis which interfere with the accuracy of the bismuth process.

We are acquainted with three principal modifications of phosphoric acid, viz.—

Orthophosphoric Acid, ...	$3H_2 O, P_2 O_5$
Pyrophosphoric, ,, ...	$2H_2 O, P_2 O_5$
Metaphosphoric, ,, ...	$H_2 O, P_2 O_5$

It is well known that these vary greatly in their relations to reagents, and their separation from a liquid containing all these modifications is a matter of considerable difficulty. But in ordinary analyses it is sufficient to determine the total phosphoric acid, without special reference to the condition in which it may be present. This end is accomplished by the bismuth process with great ease, since it is only necessary to boil the liquid with excess of the solution of nitrate of bismuth, in order to convert *all* the phosphoric acid into the tribasic modification, and conseqently the precipitate into the orthophosphate of bismuth —$Bi''' PO_4$.

In examining minerals this process yields the most satisfactory results, and the following example illustrates the advantage arising from its employment in the analysis of the so-called "superphosphate of lime."

A sample gave an analysis in the ordinary way.*

---

* By difference.

Moisture,	16.10
Organic matter, ammoniacal salts, and water of gypsum,	13.85*
Sand,	3.00
Biphosphate of lime,	15.00
Neutral phosphate made soluble,	22.50
Phosphate of lime (insoluble),	7.20
Sulphate of lime (anhydrous),	41.05
Alkaline salts,	3.80
	100.00

The determination of the phosphoric acid in the aqueous solution of the above sample was made by the ordinary magnesia process, which requires upwards of twenty four hours for its proper performance. When the bismuth process was used with the precautions already referred to the percentage of soluble phosphate of lime present was found to be 15.9, the additional .9 per cent. being due to the presence of a proportional quantity of one of the modifications of phosphoric acid not precipitable as the magnesian salt, but which is easily converted by boiling into the neutral tribasic phosphate of bismuth.

XIX.—*On the Construction of Meters for the Supply of Water for Domestic Use.* By GILBERT SANDERS, M.R.I.A.

[Read 17th February, 1868.]

THE project for supplying water to this city from the Vartry basin gave rise to much controversy during the past five or six years. There are not many amongst us who did not feel influenced, more or less, by one or other of the contending writers; but though I read most of what was written on this subject, I must confess I took but little interest in the general question. As to the suitableness of the Vartry basin, or the means by which its waters were to be made available, I felt satisfied that the Corporation would be guided in the undertaking by the advice of experienced engineers. However I could not but reflect on the probable consequences of the change from the low pressure to which we had become accustomed, and for which our fittings were constructed, to a pressure sufficient to force the water over the most exalted roof in Dublin. And it occurred to me that when water, at a pressure of from one hundred to two hundred feet, would be forced into the old and defective pipes and taps, in use for so very many years, a serious loss by wasteage would probably ensue.

---

* The results are obviously stated in accordance with conventional nomenclature.

I am aware that the Corporation had anticipated that some inconvenience would arise by reason of the defective fittings, and that they had made provisions for proper articles of that class being offered for sale. But the Corporation may find it a very difficult task to compel those people who are willing to submit to the annoyance of defective fittings to purchase new ones, especially if they know they can relieve the pressure on their split pipes and worn-out taps by allowing the water to discharge itself into the sewers, when their own cisterns or water tubs are supplied. In instances such as I have just alluded to it might not be too much to say, that eight or ten times as much water might be thrown into the sewers as would serve for all the requirements of the house.

I have had some experience of how consumers deal with an article when allowed to help themselves to it, using as much or as little of it as they please, and paying a fixed sum for the privilege. Gas Companies originally sold their gas by the burner, which is pretty much the same as supplying water at a fixed rate. The Gas Companies, under the fixed rate system, sent out from their works twice or three times as much gas as they were paid for. It was well known, though a considerable portion of the excess was caused by infractions of agreement, yet the consumers were so extremely careless in the use of gas as to keep it lighting, often hours after they had any real need of the light, and a great deal was also lost by defective fittings. No efforts of the Gas Companies could restrain the waste until they decided to sell gas only by measure. In 1842, I found, by careful investigation, that the Hibernian Gas Company was paid for about forty per cent. only of all the gas they sent out of their works in the previous year. Sixty per cent. was lost; and allowing twenty per cent. for unavoidable waste, forty per cent. was still unaccounted for; therefore the consumption was at least double the estimated quantity. When meters came into operation, in the course of a few years, forty per cent. of the waste was actually saved, which was subsequently given back to the consumer in reduction of price, the saving having enabled the Company to do so without loss of income to themselves.

Wherever water is naturally conveyed to any place, and in quantities beyond the wants of the inhabitants, no public injury can arise from allowing the overplus to pass unused into the sewers; but there are few large towns so favourably situated. However, when by growth of the population, increase of dwellings, and factories, the natural supplies of water become insufficient, or the natural sources get contaminated by the proximity of a dense population, the supply must be conveyed from some distant and more suitable locality, in effecting which, large sums of money must be expended, the interest of which, and the cost of maintenance of works, impart a real money value to every gallon of the water so delivered. The supply of water to large populations has given rise to much anxiety in many towns—Dublin one of the number. In estimating for the catchment and works for supplying large towns, calculations are made of the quantity which the town will require, and works are constructed accordingly. I believe, however, that present experience teaches that it does not always happen that the actual demand keeps within the limits of the estimate; and it has been found necessary in some instances to construct additional works, involving expenditure of additional capital.

I do not doubt the capabilities of the Vartry Works to provide a very liberal supply of water for the real wants of the city; but should it unfortunately happen that, through negligence or defective fittings, the wasteage so far exceed the estimate as to embarrass the Corporation, it would be worth their while to consider whether the application of the meter to the wasteful customers would as effectually check the waste of water as the Gas Meter checked the waste of gas. I do not say the Corporation should make the purchase of water by meter the rule for the whole city, though I am convinced it would be the most equitable way of dealing with the citizens; but the meter should be fixed on every customer who would not adopt proper means for preventing inordinate waste; and if the price charged by the Corporation will not exceed eight-pence the thousand gallons, no one will have just occasion to complain, for a thousand gallons would fill more than eight large wine pipes of one hundred and twenty gallons each pipe, or one hundred and twenty gallons for one penny. Contrast that with the cost of water in places where it is carried about for sale, as at present it is in Kingstown and Monkstown, where people, having no wells of their own, must purchase from the water-carriers, who collect the water from various wells, and sell it at the rate of one halfpenny per bucket of about three gallons, or twenty times the price I have named as the maximum for water in the city.

Impressed with the advantages of supplying water by the meter in this city, I took every opportunity, pending the construction of the Vartry works, to collect information about fluid meters. Many patents had been taken out for that kind of meter, but it did not appear to me that any of them were of much practical value as domestic meters.

About two years since I had an opportunity of seeing one of the first of a new and very simple form of meter; I was so struck with its simplicity and apparent fitness for the purpose I had in view, that I offered the patentee to have it brought under the notice of the Royal Dublin Society at one of its monthly meetings. Last autumn I had the satisfaction of seeing that meter at work at the Paris Exhibition: it was then supplying all the water required for the steam boilers in the British Section, and appeared to succeed so well, that on my return to London, I renewed my offer to submit it to your notice, and having been furnished by the patentees with some of the meters, I present them this evening to your inspection; and I do so with the greater pleasure, because I see before me many gentlemen professionally interested in the subject, and, by experience, well qualified to form a correct judgment of the merits of Mr. Payton's invention. Before, however, we examine Payton's meter, I beg your attention to the diagrams which represent the elementary mechanical contrivances adopted by projectors of former fluid meters: they are extracted from all the specifications and drawings of the patents taken out for fluid meters from 1825 to 1866, a period of 42 years, copies of which now lie on the table for your inspection. During that time no less than one hundred and forty-seven specifications were lodged. The elementary principles of all, however, are reduced to the few represented by the diagrams. For the most part, the patents are almost copies of other patents, differing chiefly in some modification of form or the arrangement of counters or valves. Many of them are complicated with levers, extra valves, and clock work, or other contrivances, intended to make imperfect principles if possible effective. In Payton's meter, however, the utmost simplicity prevails; the principle on which it is constructed receives no aid from any other. There are but two pieces in motion, viz., two cycloidal partitions enclosed in a case, formed of portions of two cylinders; one of these partitions revolves on bearings in the centre of each part-cylinder. In every portion of their revolutions these partitions approach each other, and the sides of the cylinders in which they revolve as close as possible without actual contact. By this contrivance the case is always divided into two parts, and the influx water can pass from one part of the case to the other, only by pushing forward the opposing partitions in a rotary manner, and in this way the measurement is effected. I may popularly liken the passage of the water through the meter to a stream of persons pressing through turnstiles, which mutually lock into or overlap each other. The indication or contrivance is equally simple with the machine itself, and reflects much credit on Mr. Payton's mechanical genius.

The meter, as you will observe, is diminutive in relation to its powers; for though only about four or five inches diameter, it is capable of measuring five hundred gallons per hour with twelve feet head of water—with forty feet head it passes one thousand gallons per hour. The form and finish, as well as the general appearance of the meter, resembling an ordinary circular timepiece, would admit of its being placed in the counting-house of a factory, affording facility of constant inspection; or it may be placed in any part of a private residence, without being in the least degree unsightly. To make the cycloidal portions of the correct form and dimensions, Mr. Payton invented and patented a very beautiful machine. By this machine the partitions are formed with such exactitude, that if any necessity should arise for new ones to be placed in a meter, new partitions can be sent wherever the meter may be, and there inserted by an ordinary mechanic. But it appears to me that the meter will work for a very long time indeed before the partitions, which are the only wearing parts, would require to be renewed.

I have had no opportunity myself to test the working of this invention. However, we have the report of the severe tests to which it was submitted at the "Conservatoire des Arts et Metiers" in Paris, and I have some other testimonials from competent authorities, all reporting most favourably of it as a fluid meter. From the freedom with which it works, it is to be expected there would be some loss of measurement by *slip*. The reports I have alluded to fix that loss at a very small fraction—say not exceeding 3½ per cent., at the highest; and I have no doubt that even that loss, small as it is, can be almost entirely overcome in the manufacture.

Having spent much time and care in examining the plans and specifications before me, I give the preference to Payton's meter above every other, whether for large or small supplies, and especially for domestic use.

In conclusion, I would beg to remark that the fluid meter is now manufactured by the Meter Company, which has established a branch factory at Hanover-street, in this city, and where the manufacture of gas meters for Dublin and other Irish towns is most successfully caaried on.

At the conclusion of the paper, Mr. Sanders exhibited Payton's meters in action, measuring water from a tank put in connexion with it. The index plate of the meter has been removed, as well as the brass back of the case, and a glass plate substituted for it, which arrangement permits the action of the partitions to be distinctly seen. There was also exhibited a meter which could be taken asunder, so as to show the audience every part of the mechanism.

Mr. Frith, C.E., made some observations, but chiefly with reference to an improved water-tap of his own invention as applied to cisterns.

Mr. Parke Neville, City Engineer, complimented Mr. Sanders on the way in which he brought forward his paper. He would not now say anything as to the respective merits of the meters that he had seen, but said that it was a matter of great importance that they should obtain the best description of meter, particularly where water was introduced at high pressure. He found that the waste in Dublin was enormous, and that was one of the difficulties they had to grapple with in introducing a new supply, and the same difficulty was met in all towns, large and small, into which water at high pressure was introduced. This difficulty was felt especially in Glasgow, Liverpool, and Manchester. At present the Corporation of Dublin were engaged in trying by the different means at their command to check the waste, and he thought they would take measures to test the accuracy of the meter which had been so ably brought under the notice of the Society by Mr. Sanders. He should be very much pleased if it were found to answer the purpose for which it was recommended by a gentleman of the practical experience and high scientific attainments of Mr. Sanders.

The Chairman, George Johnstone Stoney, F. R. S., remarked on the simplicity of Mr. Payton's meter, which he then saw for the first time. The Society should be much obliged to Mr. Sanders for having brought it under their notice, the more so as he was the Patentee of the very beautiful improvement in the gas meter, now in use in this city, and by which that instrument has been made an accurate measure of the gas consumed in their houses. He thought that the fluid meter having been introduced to the Society by Mr. Sanders was a strong recommendation in its favour.

XX.—*On a Cetacean new to Ireland.* By WILLIAM ANDREWS, M. R. I. A., Chairman of the Committee of Natural History.

[Read Monday Evening, February 18, 1867.]

AT a meeting of the Natural History Society of Dublin, a few evenings since, I remarked on the great interest that would attend an investigation of the marine zoology of those but little explored shores of our western and southern coasts, more especially with regard to the deep water soundings. As yet but little is known of the animals that exist in those soundings, or of the habits of such, whose rare occurrence is but attributable to their being only obtainable or met cast ashore, mostly in the dead state, after gales of wind, when the violence of the surf has thrown them beyond the influence of tides. Even then they are generally lost, being covered amidst rejectamenta, or buried in sand, where decomposition destroys all trace of discovery.

In the year 1800 was cast ashore on the estate of James Brodie, Esq., near Brodie House, Elginshire, a fine specimen of a whale. Mr. Brodie, who had been Member of Parliament for Forres, and distinguished as a naturalist, at once secured the unknown object. Its great weight and bulk prevented him sending more than the head, with a drawing and description of the animal, to the eminent zoologist, Mr. James Sowerby, but which was sufficient to satisfy that naturalist of its distinctness from any that had hitherto been described.

From the peculiar formation of the jaws, and possessing but two teeth, which were in the lower jaw, Mr. Sowerby considered it to be a whale unknown to British zoologists. It became a subject of much discussion among the *savans* at a *conversazione* of Sir Joseph Banks, in Soho-square.

According to Mr. Brodie and Mr. Sowerby, the animal was sixteen feet in length, and its girth in the thickest part eleven feet. The colour was black above, nearly white below. The cuticle on every part of the head and body was pellucid and satiny, reflecting the sun to a great distance. The sides were completely covered with white vermicular streaks. It was of the male sex.

The peculiar characteristics which led Mr. Sowerby to distinguish it from other species were—the head accuminated; lower jaw blunt, longer than the upper, with two short lateral bony teeth; the upper jaw was sharp, let into the lower one by two lateral impressions corresponding with the teeth; the opening of the mouth measured one foot six inches; the throat rough and vascular; beneath it were two diverging furrows, terminating below the eyes; the spiracles lunated, the ends pointing forward.

By Lesson, Desmarest, Blainville, and other authors, it was named Diodon Sowerbi, Delphinus Sowerbi, and Physéter bidens Sowerbyi, from the character of the teeth in the lower jaw. It would be useless to enter into the numerous synonyms, and to remark on descriptions which authors have confused, but to dwell more particularly on the species that forms the subject of this paper.

Since the time of Bonnaterre, nearly eighty years ago, the genus Delphinus has been so much augmented that numerous subdivisions were necessarily made. The illustrious Lacepede led the way, condensing all that had hitherto been known of the Cetacea into a somewhat systematic arrangement. He separated the Delphinidæ into two orders—the toothed and the toothless. Rafinisque Schmaltz, Baron Cuvier, Blainville, and Lesson followed; Desmarest also added his investigations.

In 1836, M. F. Cuvier, de l'Académie des Sciences, Paris, published his "Histoire Naturelle des Cétacés." Although not entering elaborately into scientific details, he expunged some genera, and introduced others. Thus he set aside the genus Aodon, and the Delphinorhynchus of Blainville.

J. E. Gray, F. R. S., whose scientific labours are well-known, and who has given such a valuable memoir of the Cetacea that are in the British Museum, and of those recorded in other places, published some time previous, in the Annals of Natural History, a paper on the British Cetacea, in which he has shown that Delphinorhynchus Sowerbyi, Physeter bidens Sowerbyi, Delphinus micropterus, Cuvier, R. A.; F. Cuvier, and Diodon Dalei, Lesson, were the same. At the time that the whale was obtained by Mr. Brodie, Mr. James Sowerby at once recognized the skull to be identical with the figures of the skull of Delphinus micropterus of Cuvier; Delphinorhynchus, Blainville; so that this species, as mentioned by Gray, was described and figured by Sowerby many years before its appearance on the coasts of France, for the French authors had erroneously referred Sowerby's figures to Hyperoodon.

While in Mr. Sowerby's possession, M. de Blainville, when on a visit to England, made a slight sketch of the skull engraved in Gray's Zoology, "Erebus and Terror," Table 5, and under the name of Diodon Sowerbiensis gives the following description of it:—"Head bony, the upper jaw shorter and infinitely straighter than the under, which receives it. Moreover, the lower jaw is armed at each side and in the centre of its extremity with one single tooth, very strong, compressed, and obliquely directed behind. The aperture of the blow-hole is crescent-shaped, of which the horns are turned forward."—(Blainville Desmarest, Dec., N. H., ix., 177.)

The above description and Blainville's sketch clearly demonstrate that it belongs to the genus Ziphius of Cuvier, before only known in the fossil state, and the examination of the skull has confirmed the accuracy of that view. Several species among the fossils were considered to be so completely dissimilar to all other Cetacea as to form a separate genus. The head of an unknown genus was discovered in 1804 on the coast of Provence, and which appeared to the great Cuvier as approaching to the Hyperoodontes and Cachalots. The several forms that he described of that genus, to which he gave the name Ziphius, led him to believe that they were so distinct from all known species of Cetacea, that he remarked "that they are in all probability the relics of a destroyed creation, whose living types it would be in vain to seek in our present world." A dolphin, approximating to the grampus and globiceps, was discovered by Cortesi on the acclivities of the Apennines to the south of Fiorenzuola in 1793. The skeleton was found almost entire in bluish argilla, filled with marine shells. The animal, M. Cortesi calculates, was in all probability thirty feet long. Indeed, in the words of an able reviewer, "the fossils of this order of Mammalia have an interest peculiarly their own. To find, not quadrupeds—the congeners of those which tread upon the soil—but the mighty monarchs of the deep in the centre of immense continents and on the slopes of lofty hills, cannot fail to excite the most profound reflections."

Thus it is seen that Delphinorhynchus Sowerbyi, Diodon Sowerbi of Desmarest, Delphinus micropterus of Cuvier, and Diodon Desmaresti of Risso, are one and the same species, and which are now clearly identical with the before presumed extinct genus Ziphius of Cuvier.

The Ziphius Sowerbyi was until now the only known male species taken in Europe. The Aodon Dalei, Lesson, the toothless whale of Havre, which was stranded near Havre in 1825, and described by Blainville as Delphinus Dalei, was a female, and is the D. micropterus of Cuvier. The skull which was described by de Blainville is in the Paris Museum. Another, a female, was caught in 1826 at Calvados; the skull and vertebral column are in the Museum of Caen. One was taken at Ostend on the 21st August, 1835, and is in the collection of M. Paret, near that city. It was fully described by Du Mortier as Delphinorhynchus micropterus. It was fifteen feet long and seven feet six inches in circumference. It was also a female. Another is recorded as taken at the mouth of the Seine in 1825. These are the only European recorded—four females and one male. Since the living genus Ziphius has been established several have been made known—two taken on the coast of South Africa, and one recently described as Ziphius Tasmaniensis, killed near Flinder's Island, on the coast of Tasmania.

The necessity of this introduction is to show the importance of the discovery made of this rare Cetacea on the south-west coast of this country. The skeleton of the head of this animal was obtained by Colonel the Hon. D. B. De Moleyns from Dr. Busteed, of Castle Gregory, county of Kerry, who had some idea of the value of the discovery, which Colonel De Moleyns placed in my hands to record. I will give the discovery in Mr. Busteed's own words, in a communication dated the 30th November, 1866, made to Colonel De Moleyns:—"It was on the morning of the 9th March, 1864, that the animal, which, with you, I believe to be a Diodon, was cast on the sandy beach, beneath your house at Hillville (Brandon Bay, coast of Kerry), after a high spring tide. I happened to be riding, when I perceived two men in the water pulling at a strange object, which, on inspection, proved to be part of the head of some cetaceous animal divided vertically behind the eyes, and the front portion only remaining. The rest of the body had been hewn into small pieces and carried to their homes by the peasantry. In this, however, the eyes were perfect, as also the spiracle lunated, with the concavity looking forward. The measurements were—From centre of fold of spiracle to each eye, ten inches; from same point to extremity of upper jaw, twenty-two inches; from come missure of lips to extremity of upper jaw, thirteen and a-half inches; from commissure of lips to extremity of lower jaw, fourteen inches. On the lower surface of the integuments of the neck, between the rami of the lower jaw, was a well-defined angular space formed by two depressed lines, each ten inches long, converging to an apex in front, and behind distant seven inches from each other. It is much to be regretted that, so much time having elapsed, the remainder of the head could not be procured, nor any of the rest of the skeleton."

The measurements given by Dr. Busteed are in the recent state of the animal. The head of the present specimen is that of a male. The strong lateral tooth on each side of the lower jaw is obliquely truncated at the end, the apex turning backward. The rudimentary state of the teeth of the other described European species has been supposed by some authors to indicate more the sex than age of the animal. In the present species the teeth appear worn. The animal is supposed to have been about fifteen feet in length. The angular space under the throat is described in Sowerby's animal, and appears also to occur in Hyperoodon, but Ziphius is perfectly distinct from the latter genus, by the position of the teeth.

This is the first record of the occurrence of this rare Cetacean on the Irish Coast.

The record of this rare discovery only tends to confirm the great interest that the coasts of Ireland present; but it is difficult to meet such observers as Colonel De Moleyns and Dr. Busteed. Many are the losses that science has sustained from want of proper observation. The appliances necessary for the capture of animals inhabiting deep water soundings are expensive, and the means of employing them difficult to command. With a wretchedly-contrived dredge, and not sufficiently weighty for the depth of water, I captured, in seventy and eighty fathoms, beautiful specimens of delicate and minute Crustacea, varieties of Hippolyte, of extremely rich and delicate tints, and endless would have been the forms taken were I provided with a sufficiently weighty dredge and proper scope of rope.

Dr. Joseph Hooker and Mr. Goodsir describe in the Antarctic and Arctic voyages of Sir James Ross and Sir John Franklin the great depth from which animal life has been taken up, numerous species being obtained in three hundred and four hundred fathoms. In conclusion, I cannot avoid representing the great capabilities and advantages that this Society presents for carrying out inquiries of scientific investigation (for we have enough yet to accomplish at home). Its splendid library of reference—its museum, which is in rapid progress of arrangement, under its highly scientific director and his able assistants, must greatly encourage those that are interested in the study of the several branches of the natural sciences."

XXI.—*On Certain Branches of Industry in Ireland; with special reference to the Steps taken by the Royal Dublin Society for their Promotion.* By William Andrews, M. R. I. A.

[Read on Monday Evening, January 20, 1868.]

The time allocated for the reading of a paper will only permit me to give a general outline with regard to the primary objects of the Royal Dublin Society, its position, and with references to branches of industry which are within the scope of its legitimate pursuits.

In 1731 the Dublin Society had its origin, as other institutions also had, in a private association, its objects principally directed for improving husbandry, manufactures, and the arts and sciences. The association obtained its charter of incorporation in 1749, and thence succeeded its Schools of Art, Botanic Garden, and Museum of Natural History. Although long anterior to the date 1731, when the first idea of a botanic garden in Ireland—viz., 6th September, 1692—was contemplated by a petition from the President and Fellows of the College of Physicians in Dublin to Lord Viscount Sydney, the Lord Lieutenant, for a grant of land for the formation of a College and Physic Garden, and that Botanical and other societies then existed, I shall only glance at such steps of progression which took place from the above date, 1749.

About the year 1750 a society held its meetings in Dublin, termed the Medico-Philosophical Society, its transactions tending to the advancement of medical and botanical knowledge, and in which Society Drs. Rutty, Hill, and Smith, took prominent parts; for we find that in April, 1756, Dr. Rutty "produced a catalogue of indigenous plants, and read an account of several sophistications of the herb-sellers in Dublin, who frequently substitute one plant for another, not only imposing on unskilful purchasers, but likewise on a great number of the apothecaries themselves." This Society continued its proceedings for some years, extending its investigations into the natural history of Ireland. The works of Dr. Rutty with reference to the county of Dublin, and those of Smith's histories of Kerry, Cork, and Waterford, bear ample evidences to the value of their researches at that period. That Society formed the nucleus from which the Royal Irish Academy sprung.

The memoirs of the Royal Dublin Society exhibit a steady interest in the promotion of the agricultural improvement of the country, which it encouraged; and we also find that in the beginning of the present century an effort was made by the Government in behalf of the fisheries under the management and controul of the Society.

The lamentable state of ignorance of agriculture and farming, and the extreme difficulty of intercourse with the more remote counties, influenced the Society to undertake statistical surveys, and by the employment of enlightened and experienced agriculturists, to stimulate improvement, and a better knowledge of husbandry. The labour of such a task may be shown, and which may be generally applied, from the observations of Hely Dutton, Esq., who completed the Statistical Survey of the County of Clare, 17th March, 1808. He says—"It is extraordinary how little interest the gentlemen of this county, and, indeed, of every other in Ireland, take in any publication intended to promote the improvement of their country. I do not think there are three houses in the county that have any of the statistical reports. One would imagine that even curiosity to see what was doing in other counties would prompt them to obtain them; indeed, except 'Taplin's Farriery,' 'Glasse's Cookery,' and 'Maw's Calendar,' I scarcely ever saw a book but in the houses of the few who had seen the world."

Previous to the year 1800, the Society employed Mr. Donald Stewart as itinerant mineralogist to the Society, and the value of his labours may be seen in the "Journal of the Transactions," published for the year 1800. The reports of Stewart show that he had examined twelve counties in Ireland, discovering marls, limestone, and other manures, not before known to the landlord or tenant, as existing in their several localities. He also made known many valuable minerals and earths useful to the manufactures, and instructed the peasantry in the most useful methods of employing and coking bog-turf.

In 1816, a statistical account or parochial survey of Ireland was published by William Shaw Mason, M. R. I. A., Secretary to the Board of Public Records, and which was drawn up from the communications of the clergy. But little advancement in many parts, even at that period, appears to have been made. From a report of the Select Committee of the House of Commons, "On the State of the Poor in Ireland," ordered to be printed by the House of Commons 16th July, 1830, we gather how lamentable was the state of the country, and how backward were its industrial pursuits in many of the counties of Ireland. Mr. Nimmo, an engineer, who had been much employed by public departments, states, in 1823, "that the fertile plains of Limerick, Cork, and Kerry are separated from each other by a deserted country, hitherto nearly an impassable barrier between them. This large district comprehended nearly 600 Irish, or 970 square miles British. In many places it is very populous. As might be expected under such circumstances, the people are turbulent, and, their houses being inaccessible for want of roads, it is not surprising that during the disturbances of 1821 and 1822 this district was the asylum for Whiteboys, smugglers, and robbers, and that stolen cattle were drawn into it, as to a safe and impenetrable retreat. Notwithstanding its present desolate state, this country contains within itself the seeds of future improvement and industry."

Such was the state of things in 1822—a large tract of fine country neglected and destitute of all improvements in husbandry, and where, on its western and south-western coasts, perpetually hovered formidably-armed smugglers, the Big Jane cutter, and the luggers, Blue-eyed Maid, the Round O, and the Fox, ready with facility to deliver their valuable cargoes of tobacco, brandy, Hollands, silks, tea, coffee, and pepper, which were quickly conveyed from the vessels by bands of daring and hardy fellows who manned the corrocks and hookers that were at that time in hundreds from every village that then dotted the cliffs and shores of those coasts.

Subsequently, an engineer of eminence, Mr. Griffith (now Sir Richard), was employed to execute public works in that district, under the authority of the Government. He confirms the former statement of Mr. Nimmo. "This tract," he observes, "is a wild, neglected, and deserted country, without roads, culture, or civilization. It chiefly belongs to absentee proprietors; and being for the most part inaccessible, has hitherto afforded an asylum for outlaws and culprits of every description." In seven years afterwards (after the execution of the works), Mr. Griffith reports:—A very considerable improvement has already taken place in the vicinity of the roads, both in the peaceable order and industry of the inhabitants and the appearance of the country, and where a few years previous to 1824 there was hardly a plough, car, or carriage of any kind; butter being the only produce, was carried to Cork on horseback, and in that part of the county of Kerry the nearest post-office was thirty miles distant.

The facilities of communication had rendered so available the advances of husbandry and productive purposes, that in the Cork district, where Mr. Griffith had in seven years expended £600,000, the increase of Customs and Excise had been £50,000 a year. The same improvements were manifested in Galway and in Mayo. Through the encouragement and example afforded by the Royal Dublin Society, the quality of agricultural produce had greatly improved, and the quantity increased. The description of stock in husbandry were of a better class since the increased intercourse with England, and which encouraged the introduction of the Hereford, Ayrshire, and Leicester breeds. Agriculture had advanced by the mode of ploughing, the description of carts, and other farming implements employed.

In 1824 the first commercial steamer was established between Dublin and Liverpool by the late Charles Wyse Williams, Esq., a gentleman of the highest enterprise and most active public spirit. Ireland, as Mr. Blake, the Chief Remembrancer of the Court of Exchequer, observed in his evidence in 1830, is becoming from day to day more prosperous—capital is spreading throughout Ireland, and in proportion as it spreads so will the general state of all classes be improved.

The main features so necessary to the improvement of Ireland are the reclamation of bogs and waste lands, the embankment and drainage of marsh lands, the encouragement of manufactures, and the extension of its fisheries. The climate of Ireland has been stated to be adverse to agricultural prosperity, and its varied and humid nature unsuited to cereal crops; yet in districts in Ireland where stiff argillaceous soils exist, the finest wheat has been grown, the deficiency of the crop being as much owing to the nature and composition of the soil as to climate. The perfection of what has been termed a maritime climate is seen in the West of Ireland, where a perpetual verdure exists throughout the winter, but the mild winter is coupled with a less genial summer. The growth to maturity of cereals and of the most useful vegetable products, depends much on the intensity and duration of summer heats, and is but little affected by the severity of winter. The mildew, or blight in corn, caused by a parasitic fungus (Puccinia graminis), is not confined to the climate of the British Isles; it occasionally occurs in every part of Europe. Italy is very subject to it; Sicily has been visited, and even new South Wales, more or less, has suffered from its ravages.

At a meeting of this Society, held on the 21st of November, 1864, Sir Robert Peel, then Chief Secretary for Ireland, gave a very able review with regard to the waste lands of Ireland, bearing on the paper of the evening by Lane Joynt, Esq., " Suggestions for the Amendment of the Arterial Drainage Laws." Sir Robert Peel leaned to the view that thorough drainage was more suited to the reclamation of upwards of 4,000,000 acres of land, waste, or bog, and uncultivated in this country, than arterial drainage, and that it was concurred in by that most distinguished civil engineer, Sir Richard Griffith, who had for so many years been at the head of the Board of Public Works—a board that had done good service for Ireland, and who stated that there is no bog in Ireland that cannot be drained. Sir Robert's observations were highly complimentary to the Society, which he termed a *justly distinguished and patriotic Society.*

A very large tract of country remains in almost a primitive state—vast expanses of morass, of rich alluvial surface, covering large tracts of submerged forests, and which perpetually give out chilly and damp exhalations, so injurious to cultivation and to stock, and those features prevalent in a climate otherwise possessing the utmost fertility. In 1846 it was computed that there were 1,576,000 acres of flat bog, 1,254,000 acres of bog, that form the covering of mountains, being a total of 2,830,000 acres of bog capable of improvement; and according to the quantity of waste stated by the Emigration Committee, there are 2,070,000 acres of mountain, &c.

For many years, in my botanical explorations of the mountain wilds and valleys of the west and south-west, I have watched the progressive changes that have occurred—marshes drained, bogs turned into verdant pastures, and a great extent of acres presenting luxuriant crops of turnips, mangel wurzel, and even wheat, that for ages had grown only Cyperaceæ and aquatic plants. It is singular, in these changes, to have remarked how *Drosera*, *Pinguicula*, *Hydrocotyle*, and the marsh *Ranunculaceæ*, have given way to *Euphrasia*, *Galium verum*, called *Cucuillean*, and to a variety of upland plants that affect dry pastures, but which had no previous existence in the locality.

Pines of large growth once covered immense tracts in the western and southern parts of Ireland, but now all submerged. Occasionally enormous trunks are excavated from the bogs, and cones of the stone pine (*Pinus Pinea*) have been found imbedded with the timber. Primitive woods of the oak, ash, holly, and poplar, and the hazel, still exist, and in the most swampy ground the alder luxuriantly thrives. In partially-drained bogs in Kerry I have often been surprised at the luxuriant crops of turnip and mangel wurzel, and the enormous cabbage that have been produced, and especially rape or cole seed, *Brassica Napus*. I have seen fine plants of *Brassica Campestris* grown in Kerry in the reclaimed bog land. It is a most valuable crop, much cultivated on the Continent, the seeds of which are crushed, and make the colza oil. The haulms burned are an excellent stimulant manure for clover. After marsh drainage no crop grows more luxuriantly than colza.

Ireland is suited to the introduction of good timber trees. The splendid woods of New Zealand would flourish in the equable climate of the south-west, and the drainage so necessary for the growth of pines would add to its better temperature. There the Rimu and Kakikatea, and also the Towai, valuable for their timber, might flourish, with the Puriri, Miro, and Totara, also the beautiful flowering Titree and Karaka. The woods and seeds of these I have obtained from New Zealand, and many raised from seed are growing well. The specimens of pine woods exhibited, that might be useful to introduce, were of the hardier timber trees of the higher grounds of the lands of New Zealand, and where the climate is even more chill and variable than in England. The summits of many of the ranges of mountains are covered with perpetual snow. A plant of the blue gum tree, *Eucalyptus Globulus*, which I raised from seed brought from Tasmania, bore the winter frosts well, and in two years attained a growth of thirty feet. Many years since, when visiting the beautiful grounds of Lord Kenmare, at Killarney, I observed to Mr. Boylan, the intelligent steward and forester, the splendid growth in the grounds of the South Carolina swamp pine, *Pinus palustris*, and said where that plant could stand all seasons, with such vigour of growth, the introduction of even the more delicate pines could be made. The hint was sufficient; towards the lake a swamp existed, but which now exhibits a fine pinetum, with luxuriant swards and green crops. Many of our introduced plants that are treated in the greenhouse would grow more robust, and more readily flower in the open gound. The shrubs of Japan and Northern China will all bear this climate, and no more dense or protective hedge-row can be formed than by *Cryptomaria Japonica*, which will bear clipping to any extent. At Hazlewood, Sligo, I have seen *Trichomanes radicans*, *Pteris longifolia*, of the West Indies, and *Adiantum capillus Veneris* growing and fructifying most profusely on the rockery in the open ground, and there also *Woodwardia radicans*, its fertile fronds propagating and spreading like the walking fern, *Camptosorus Rhizophyllum*. It is the equable climate that suits these plants, for they will bear the extremes of heat or of cold, if the temperature be not variable. In the peat bogs of the south-west the New Zealand flax, *Phormium tenax*, attains all the vigour of New Zealand growth.

A vast extent of fertile soil spreads over and along our mountain ranges, where springs and inundations chill the ground, but where, by diverting the streams, and thorough draining, fine farms are gained for the depasturing of sheep and cattle, and where the slopes and gorges would grow the finest timber, and none more suitable than the black Austrian pine, and the Corsican pine, *Pinus laricio*. Pines require drainage and a porous substratum. Thus the stunted growth of many plantations is caused when the roots meet a cold substratum too retentive of moisture. The finest hollies and box trees in Kent and Surrey, producing the hardest and best woods, are grown in a gravelly soil over a substratum of chalk. The Crimean pine, which grows in the countries of the Black Sea, affects a similar soil.

Sheep draining has had wonderful effect in producing excellent pasturage, and freeing the grounds from confined moisture that lies stagnant beneath the soil It is such soils that produce the rot in sheep and disease in cattle, especially the fatal form of attack, *pneumonia*. In my rambles through the country the farmers have shown me plants which they said had destroyed their sheep and made their cattle lean, on lands where *Hydrocotyle vulgaris* (white rot), *Pinguicula*, *Ranunculus flammula*, and *Pedicularis palastris* abundantly grew. It was useless to say the plants were not the cause; my only advice was, drain and lime your ground, the obnoxious plants will disappear, and your cattle become healthy. The *Hydrocotyle*, they avow, attacks the liver of the sheep, and also produces giddiness. The plant is named in Irish Leithe uisge. Galar Creathan (as it is termed), or shaking disease, that affects the sheep, is very prevalent. Some years ago, at a farm near Ventry Harbour, coast of Kerry, thirty valuable sheep were lost, all attributed to Leithe uisge. The fatal form of that disease was the development in the brain of the sheep of the parasite *Cœnurus cerebralis;* the parasite that attacks the liver is *Distoma hepaticum*. The *Cœnurus* consists of a vesicle or bladder of variable size, seldom exceeding the size of a walnut or pigeon's egg, containing an albuminous fluid; Hydatids are numerous, seen on the surface of the vesicle. The vesicle increases in size, until by pressure on the brain the sheep ultimately is destroyed. The only mode in which the sheep has been relieved is by causing the rupture of the Hydatid, but this can only be done when it is seated at the surface of the brain, in which case the absorption of the bone is produced by its pressure; the bone yields to pressure at the part, and becomes so thin as to permit it to be readily perforated with a Trocar—the evacuation of the fluid causes the Hydatid to shrink, and the sheep may recover. The common adaptation of the name measles, or measly, in the flesh of the pig, is the result of a small animal in the cellular membrane of the muscular tissue, and which is a species of *Cysticercus, C. Cellulosæ.* Young pheasants, partridges, and poultry are fatally attacked by a remarkable parasitic animal, *Syngamus trachealis,* which forms in the trachea or windpipe. Thus it shows how intimately zoology is connected with agriculture, for the want of that knowledge must result in the treatment of complaints upon unscientific and vague principles. The epidemic that so fatally among cattle devastated many parts of the Continent and the British Isles mercifully did not reach Ireland. Climatal influence, nourishing fodder, and pure water, preserved our cattle. Two years since I was invited to see some cattle in Kerry suffering from the epidemic. Some were much wasted, and suffering under attacks of *pneumonia.* The pasturage was moory, grazing scanty, and covered with plants of *Pedicularis,* and *Ranunculus flammula;* the land in a cold, clay slate district—the cattle evidently suffering from the chill damps of stagnant moisture. The cases appeared to be identical with the symptoms so well described by Mr. Robert Olden, veterinary surgeon in Cork, in his communication to Edward Bullen, Esq., then Secretary of the Royal Agricultural Improvement Society, dated 14th September, 1841, and published in the *Irish Farmers' Magazine* for October, 1841.

Thorough drainage and embanking are the main principles of agricultural advancement, yet judgment and experience are required in the directing of the course and depth of drains, for there are circumstances in which injudicious over-draining may render the land valueless. I have been supplied with the following by Mr. Andrew Corrigan, the energetic and experienced Curator of the Agricultural Museum department of the Society:—"From the year 1764 to 1775, through the exertions of the Royal Dublin Society, 18,038 acres of bog and mountain were reclaimed and brought into tillage, and premiums by the Society were paid to the extent of £14,660." Nurseries were also formed by the Society for the distribution of the most useful and ornamental trees, as well as of plants, for the improvement of horticulture. The encouragement to planting was so beneficially promoted, through the influence and assistance of the Society, that the records give that, from the year 1776 to 1806, no less a sum for those objects than £18,460 had been expended, and the number of timber trees planted throughout the country was 55,137,000; and this large amount was independent of £6,000 given for raising plantations of poplars, Scotch firs, &c.; and both these sums were irrespective of the gold and silver medals for all advancements in agriculture and improved stock that were brought into or bred in the country. For statistics relating to the introduction of valuable breeds of cattle and other stock, and to the improved implements of agriculture, an able expositor will be found in Mr. Corrigan. In a military point of view I can vouch for one fact, that the strongest and most durable horses for the service of the Royal Artillery, during the Crimean War, were from Ireland.

The proceedings of the Society show the importance of flax cultivation, and what has been accomplished. Several speculations have been attempted to turn to account the peaty bog lands, by the compression of turf for fuel, and there is no reason not to believe but that such an undertaking would ultimately be successful, nay, even required, when we find that the enormous drains upon English coals, by consumption and exportation, are upwards of 80,000,000 of tons annually. The market price of compressed fuel was 11*s.* per ton.

I now come to a very important branch of industry—that of our fisheries, often discussed, yet for their furtherance no beneficial results have been directed or attained. I shall slightly touch both upon our inland and on our sea-coast fisheries, especially referring to enactments and to points of inquiry that have recently been the subjects of consideration. It may be recollected that in the month of January, 1863, I had the honour of giving a paper to this Society—"Notes on the Salmon Fisheries of Ireland." Those notes on the habits of the salmon, and the scientific and practical observations that I had for years carried on throughout the different seasons, amid the rivers and lakes of our western and south-western highlands, were fully corroborated by the late Andrew Young, of Inverness-shire, one of the most experienced and practical men of the salmon fisheries of Scotland. In that paper I had stated, from observations I had made during the two previous years, that "the favourable season of 1861, and the equally favourable winter of 1861–2, will yield us an abundance of fish for the year 1863." In that year it was thought desirable to carry out certain views with regard to those fisheries, and to introduce an Act for the removal of all those modes of fishing that were said to have caused the almost utter extinction of the salmon in all the rivers of the country, and to preserve the remnant every effort was made to impress upon the Legislature the importance of an immediáte measure of the kind. To aid these views, truthful reports were not noticed. An eminent lawyer, in his compilation of his "Fishery Laws of Ireland," published in 1863, states:—"Nothing can be more disastrous than the present state of the fisheries of all kinds—that of herrings diminished—that of oysters deteriorated, and that of salmon declining." And thus passed the Act of the 28th of July, 1863, relating to the salmon fisheries of Ireland. With reference to the salmon fisheries, Mr. Barry, Inspecting Commissioner of Fisheries, had furnished a report, which he had rather elaborately, and with a great deal of trouble, prepared, on the progressive improvement of the salmon fisheries of Ireland. That report was presented, for submission to the Board, on the 27th April, 1863, but no notice was taken of it until the 24th July following, three months after the date of the report, and four days before the passing of the Act of 1863. In that report Mr. Barry observes:—"Very little remains to be said of the salmon fisheries; the season has been generally admitted, with only a few exceptions, to have been most unusually productive, and the prospects most favourable;" and this fact was given in evidence by Mr. Barry before the Select Committee of the House of Commons on the 25th June last.

The most reliable facts of the day are those quoted by the press, the most faithful chroniclers when need demands. Referring to the market-notes given by *Saunders' News-Letter*, the *Irish Times*, *Daily Express*, *Freeman*, and other journals, and their occasional observations, a few selections will suffice. First, with reference to market-notes, the prices of salmon were:—in 1863—February, 1*s.* to 2*s.* per lb.; July, 7*d.* to 8*d.*; country, 4*d.* to 6*d.*; August, 7*d.* per lb. 1864—February, 1*s.* 8*d.* to 2*s.*; March, 1*s.* 10*d.*; July, 1*s.*; August, 1*s.* to 1*s.* 2*d.* per lb. 1865—February, 2*s.* 6*d.* to 3*s.*; March, 1*s.* 8*d.* to 1*s.* 10*d.*; April, 1*s.* 8*d.*; June, 1*s.* to 1*s.* 4*d.* 1867—February, 3*s.* to 3*s.* 6*d.*; end of the month, 2*s.* 4*d.*; May 4th, 1*s.* to 2*s.*; June, 1*s.* 2*d.* to 1*s.* 4*d.* per lb. Respectable fishmongers could not or did not generally supply the bestfish at those prices. Thus it will be seen that each year, from 1863, the prices have been increasing, and the scarcity greater. The *Daily Express* of 23rd January, 1863, observes, "That Mr. William Andrews had stated that the salmon fisheries of Ireland had increased of late years to a considerable extent, and he predicted that the ensuing season (1863) would be one of the best that had ever been experienced." The market-note, *Irish Times*, dated 22nd August, 1863—"Salmon has also been abundant, from 7*d.* to 8*d.* per lb. Latterly the take everywhere has been large." Compare these notes with the review given in the *Irish Times* 22nd June, 1867, on the state of the salmon fisheries in that year, and commenting on the effect of the Act of 1863, which remarks—"It was urged in support of the Act that private interest should give way to the public advantage. The rivers, it was prophesied, should abound with salmon, and that delicious fish would be sold in the Dublin markets at the price of 6*d.* the pound. The Act has by no means realized these prophecies. The rivers do not abound with fish; in many streams the salmon have declined, and every householder knows that salmon cannot be procured in the Dublin or country markets, except at a price which places it altogether out of the reach of the general public."

It certainly does appear that the Act of 1863 has not benefited the salmon fisheries of Ireland, although it has been expressed that "the increase is more real than apparent;" and in the Report of the Special Commissioners for Irish Fisheries, of 1865, it is stated—"But the promise of an increased supply of cheap salmon is not the only, nor, indeed, the greatest public gain that has been obtained by the Act of 1863."

I have never advocated the use of fixed engines in the manner they had been so extensively and illegally worked; but my opinion always has been, that had the Act 5 & 6 Vict. been carried out strictly, and in all its integrity, there would have been no necessity for subsequent Acts, that have more perplexed than advanced the state of our fisheries.

It is not necessary here to enter into any statements, scientific or practical, on the habits of the salmon or peculiarities of rivers, but information derived through such investigations would be more likely to ensure what is expressed in the Report for 1865, "That the Irish fisheries will yield a return that none but the most sanguine now look for." It is to be hoped, however, that, with proper protection to the fish in the upper waters, the salmon fisheries may yet progress.

I would here wish to submit to the Society the beautiful specimens of the Salmonidæ, prepared under the superintendence of Dr. Carte, the Director of the Museum. The casts were originally designed by the late Dr. Ball, of Trinity College, and the entire series, illustrating the fish of our inland waters, and also those of the coast and deep sea fish, taken from the finest specimens that could be obtained, were presented to the Society by that University. Those now exhibited are a fine specimen of the pike (*Esox lucius*); those of the salmon (*Salmo salar*) displayed that fish, in its beautiful silvery state, from the tidal water—those, after remaining some time in the fresh water, and the male and female fish, after spawning, their condition before returning to the sea. The Sea trout (*Salmo trutta*) was also beautifully exemplified. These were all finished either from recent specimens of the fish, or from the most accurate drawings. The novelty consisted in the adaptation of a coat of silver leaf, on which transparent colouring was laid. The highest praise is due to Mr. Cullen for the perfect manner the casts were prepared, and to Mr. Whelan for the delicacy and accuracy of the painting.

Papers on the sea-coast fisheries have so often been brought forward and discussed, that but little would remain to advocate their importance, were it not the perpetual outcry for their more extensive legislation and more full development. In these movements we have been placed in a sadly retrograding position—indeed, presumed to be in utter ignorance of every knowledge, both practical and scientific, of a branch of industry that has always been lauded as one of our great sources of national wealth. Mr. Blake, the member for Waterford, was unwearied in his exertions to promote the Irish fisheries, and he obtained a committee of the House of Commons to listen to the incompetency we laboured under, and how much instruction we required to take advantage of the great resources around our coasts. It was necessary that we should have surveys, vessels to test the fishing-grounds, and, in fact, a complete commencement, to place us in a way of learning the advantages that were within our grasp.

It has, however, been lost sight of, the valuable Admiralty surveys which have been made of the entire coasts of the British Isles, and of every part of Ireland, including bays, estuaries, and deep water soundings, which are so accurately laid down, whether rocky, coarse gravel, shelly, sandy, or mud and sand, &c., that any one of practical or scientific attainments could decide by the peculiar character of the soundings what mollusca, crustacea, or other objects of animal life, were likely to exist, and consequently the fish most likely to frequent those soundings. So far back as 1848, Sir Charles Trevelyan, when Secretary to the Treasury, in his communication to me, dated 20th July of that year, with reference to the employment of a Government vessel to test and to prove the fishing grounds of the coast, and surveying the fishery banks of the western coast of Ireland, observes, "that Lord Auckland (then

First Lord of the Admiralty) had this subject fully under consideration about a year ago, and the conclusion at which he arrived, in which I fully concurred, was, that what was most wanted in that quarter was, not new information regarding the fishery banks, but capital and skill, and well-conducted, persevering enterprise, to make use of the abundant means which were already known to be available." We have for our guidance one of the best reports of inquiry on the state of Irish fisheries that has yet been compiled—the "First Report of the Commissioners of Inquiry into the State of the Irish Fisheries, with the Minutes of Evidence and Appendix," 1836. Separate the useful portions from the dross, and there will be found more valuable statistics pertaining to the fisheries of Ireland than have been collected at any subsequent period.

I cannot avoid making some comments on portions of evidence adduced before the Select Committee of the House of Commons, published in Report, 19th July, 1867. The evidence given with regard to the seasons and conditions of sea fish, their spawning states, are so amusing and contradictory, that it would not be worth even alluding to, were it not for views so pertinaciously adhered to by non-practical *savans*, of our ignorance—aye, and their own admitted ignorance of every state of condition of the fish of our coasts. Those views would have but little moment were it not that their position would have weight and influence with those who had neither time nor ability to question their soundness. Who ever heard of such preposterous views as that of cod fish spawning far at sea, and the impregnated ova taken in a towing-net, floating on the surface!—again, displaying ignorance of science at home by depending on the opinions of Continental naturalists. Any one with a knowledge of the subject must be aware that the impregnated ova of fish, having vitality, are of specific gravity heavier than water. It reminds me of Mr. Keiller, quoted in "Lloyd's Scandinavian Adventures," who states the habits of the salmon of the Save in Norway to be such as are altogether different from that of the British Isles, forming no channel for the deposit of the ova, but allowing them to float down the stream, impregnated by the milt, similarly floating, and, finally, whatever escapes the rapacity of the river fish settles in some crevice or rock until the fry is exuded. The evidence of Colonel M'Kerlie, Chairman of the Board of Public Works, is worthy of notice. He states he has no practical knowledge of fishing; yet he considered himself perfectly competent to decide on all practical questions from inquiries that came before him. And yet Colonel M'Kerlie's evidence, wherever he obtained his views, was more sound and more reasonable on the spawning peculiarities of our sea fish than any so sagely advanced by those whose ideas of science should have taught them to have arrived at more correct conclusions.

The regulations with regard to the oyster fisheries of Ireland appear well adapted to their preservation, and any infringement or alteration would eventually be destructive to their interests.

The absolute necessity of regulating, and enforcing close seasons, to prevent the unlimited dredging which has been exercised, are essential to the guarding against total denudation. It is singular the large demand in the London market for the Mussel, and for the Periwinkle (*Littorina littorea*). The increase of growth of the Mussel is rapid. It is reported of the Amphion Frigate, which lay at moorings in the Medway in 1865, after four months at anchor, six tons of mussels were scraped from her bottom.

The evidence that it is not necessary to encourage the fisheries for the supply of seamen is absurd, and stating the merchant service supplied the navy. Now, it is notorious that the supply of seamen is insufficient, and that our merchant ships are often half manned by foreigners. From the Merchant Shipping Reports at the end of the year 1866, it is shown that in the United Kingdom alone 28,072 vessels of 5,692,010 tons were registered, employing crews numbering 250,516. These were altogether independent of the Channel Islands, and other British possessions.

One of the most important steps to illustrate science is the formation of an aquarium, which has been planned for the Gardens of the Royal Zoological Society. To you, Sir (the Chairman) the admirable arrangements are due that are likely to be carried out. You have to a sub-committee, meeting after meeting, given much of your valuable time to have its organization complete, so that the habits of animal aquatic life, both in fresh and in sea water, can be admired by the general public, and studied by the scientific. You have long anxiously kept in view what will be one of the most attractive displays in those gardens. I have often admired the beautiful states of the living animals of the corals of the Mediterrannean in the Jardin d'Acclimatation at Paris. How pleasing it would be to examine in the living state the polypes of *Millepora cervicornis*, fine specimens of which I have taken in deep water off the Blasket Islands, the animals of which species and the *Palmipora alcicornis* of the West Indies have been but imperfectly examined; or to view the workings of the little Crustacean, *Chelurus destructor*, which caused such injuries to the piles of the timber-work of the old jetty at Kingstown. No one can imagine the beauty of *Eunice tubicola, Amphioxus lanceolatus*, and *Sepiola Rondeletii*, when taken in the living state. Specimens in spirits convey no idea of beauty of form or of colour. *Gorgonia flabellum* of large size has been taken in the Blasket Sound, and I have some hopes that *Oculina prolifera* and *Hyalonema* may yet be dredged up in deep water off the south-west coast.

In the first part of this paper I endeavoured to show the state of the country when the Royal Dublin Society's exertions were put to the utmost to civilize its husbandry. We now see through a long career, aided by a kindred society, the Royal Agricultural Improvement, the results. The splendid shows of horses, horned cattle, sheep, pigs, and poultry, the great advancement of agricultural produce and introduction of improved machinery, evince the great strides that have been accomplished throughout the country. Science and practice must go hand in hand to acquire certain and definite knowledge. The society possesses a large and valuable library relating to all branches of science and industry; a museum of reference, in which all objects of natural history, useful or injurious to agriculture, to the fisheries, and to other branches, can be examined or explained; also an ethnological collection, containing unique specimens, a fine collection of fossils, an extensive series of minerals, an Agricultural Museum, and last, though not least, its splendid gardens, where practical botany, and every system of science and art connected with the vegetable kingdom can be learned and viewed. Such a combination must place the Society in a high position in the Empire.

With all that has been put before you this evening of progressive improvement, there still remain nearly 4,000,000 of acres unreclaimed —a great portion necessarily so; but what we want (as Sir Robert Peel observed) to see, is that steady, that useful employment of the agricultural labourers, which will do away with all the talk about emigration being the safety-valve of Ireland. It is a question now whether the country does possess a sufficient quantity of labour to develope its resources.

Perhaps no country is more free from monetary difficulties than Ireland. No speculative views embarrass its commercial tendencies, and there cannot be a doubt but that capital does exist in the country; its non-employment, however, in the country is the question to be solved.

The Chairman, Sir DOMINICK J. CORRIGAN, M. D.:—" It is usual here for the chairman, when a paper has been contributed, to draw attention to it either in the whole or in its parts, either in the way of explanation or of commentary. In the way of explanation I feel that nothing is needed, because Mr. Andrews' observations have been so clear that it would be impossible to add to them. Criticism or commentary on my part would be quite presumptuous. If we had more like Mr. Andrews in the country it would be well for us, and it would be well for our country. He (Mr. Andrews) has a mind which I cannot better allude to than in the words of a celebrated professor of science, once in Ireland, now translated, I am sorry to say, to Scotland, because Ireland presented no place that could repay him for his exertions. He says that it combines the most acute powers of observation with an enthusiastic love of natural science, and, added to all, an ability to give a practical bearing to theoretic truth, and render the discoveries of science valuable for the prosperity of his country. (Hear, hear.) This characteristic of his mind is one which we seldom see, and we may well ask how has that extraordinary quality been acquired. I am proud to say that it has arisen from the fact that Mr. Andrews, in the early part of his life, was a student of the profession to which I have the honour to belong. I do not say this as a compliment to the profession, but because it bears an important relation to one of the most important questions affecting this country at present—the education of the middle classes, on the prosperity of whom the prosperity of our country depends. Mr. Andrews' mind was cultivated in this way, that having devoted himself to the study of the medical profession, he acquired a knowledge of those branches of education which, instead of being peculiar to my profession, ought to be branches of education with which every man in the country who aspires to a position of emolument or to the education of others ought to be acquainted. These neglected branches—zoology, botany, chemistry, natural and experimental science, in their various branches, which, I ashamed to say, are confined too much to the early years of my profession—ought, in my opinion, to form elementary branches of the education of every man in the country. I read with pleasure a few days ago an account of an interview, on the subject of intermediate education, between the Lord Lieutenant and a deputation from the Convocation of the Queen's University, of which I have the honour to be a member. They pointed out the blot on the country, but dwelt a little too much on Latin and Greek. They are great ornaments, no doubt. I would not decry the terse poetry of Horace and the rounded periods of Homer; but neither will teach a man to measure his field or to drain it; neither the one nor the other will teach him chemistry, or the application of science to manufactures; neither the one nor the other will teach him natural history; and I would, if I could, divert the mind of the country into those branches which have a practical bearing on every hour of our existence and the prosperity of our country, whether we regard agriculture, mining, cattle, or manufacture. (Applause.) Men who have minds, and there are not many, have tremendous difficulties to encounter. One of the greatest is this, that when they acquire information to give to their fellow-men, and attempt to sow the seeds, they are in the position of the agriculturist, who, no matter what the seeds, has only the stony ground on which to throw them. The mind of the country—and the sooner we learn it the better—is as uncultivated as the barren soil of our bogs; and when a few men like Mr. Andrews come forward and sow the seeds, they do not produce fruit, because there is no intellectual soil in which to grow. The education of the middle classes—and the sooner it is known the better—is on the lowest par in Europe, and when a few men come forward and attempt to give us information, it is thrown on soil which is not productive, and men who do not understand it undervalue it. He (Mr. Andrews) has alluded in his concluding observations to the Royal Dublin Society. (Applause.) The Royal Dublin Society deserves the support and the praise of every man who has the good of the country at heart. Through all the trials of the country it has become the rallying point—that grand centre that has combined theoretic truth with practical knowledge. That is what we want, and it has ever taught us that we ought to place our dependence on self-reliance. There is a little song of which I might remember two lines, and which I will give you, as I think it would make a good motto for our society—

> "You will not sigh
> If you only will try
> To paddle your own canoe."

Dr. Stewart confirmed the opinion of the Chairman as to great want of middle class education.

Mr. Thomas F. Brady, said that in 1863 the Board of Works, upon his recomdation, repealed a By-law, since which the fisheries had been prosperous. He defended the removal of fixed engines for the capture of Salmon. In 1866 the largest quantity had been taken in Ireland up to that period. In 1867 the quantity was somewhat less, but now the quantity was very much in excess of that observed in previous years. On the whole, as the result of the recent legislation, the take of Salmon had decidedly increased, and in some cases the number of men employed had increased fourfold.

Mr. Jonathan Pim, M.P., said:—"I have heard the paper read by Mr. Andrews with the greatest possible pleasure, and endorse every word which you, Mr. Chairman, said in connexion with it. I am glad you alluded to the question of intermediate education, for it is truly one of the most important which is now occupying the minds of the people of Ireland. It is but right that this Society—which is a scientific one—should declare its mind on this all-important subject; and I have listened with great attention and pleasure to the remarks of our excellent chairman. I hope the Irish people will not allow the Executive to lose sight of the question, even if they should have a mind to do so."

Mr. John Bagot advocated the employment of capital in promoting the deep sea fisheries.

XXI.—*Notes on the Physical Geography, Geology, and Mineralogy of the Colony of Natal, South Africa.* By Robert James Mann, M. D., F.R.G.S., F. R. A. S., F. M. S., &c.; Superintendent of Education in Natal.

[Read 18th May, 1868.]

The Colony of Natal is situated on the south-eastern coast of Africa, 800 miles beyond the Cape of Good Hope, and looking out to the sunny Indian Ocean, between the 29th and 32nd parallels of south latitude, by a coast line about 150 miles long.

The existence of this land was first made known to civilized men in the year 1497, when the Portuguese Navigators sighted it on their way to India by the earliest voyage made by rounding the Cape. They landed on some part of this south-eastern African coast about the season of Christmas in that year, and hence called the region "Terra Natalis"—the Land of the Nativity. The modern designation of the Colony has been derived from that old Portuguese "christening" of the perhaps wider region. Natal is, at any rate, a part of the Terra Natalis of Vasco de Gama and his adventurous companions.

For centuries after its discovery by the Portuguese this region was held exclusively by wild animals and a few scattered tribes of altogether barbarous men. The aboriginal inhabitants, however, were in the first instance of gentle character; they lived in small clans, under separate patriarchal chiefs, and cultivated the ground, and rarely engaged in any warlike proceeding that assumed a more formidable character than that of a petty quarrel. Towards the end of the last century, however, one ambitious and exceptionally clever chieftain gained an extended ascendancy over the surrounding region, and formed a military despotism which absorbed into itself a considerable number of the neighbouring tribes. The large and powerful following of this ambitious and aggressive chief gradually became the terror of the entire land, under the designation of the Zulu Kafirs. At the beginning of the present century the territory, which now lies safe within the boundaries of the British dependency, was almost depopulated by the proceedings of this chief, and the Zulus fixed their own military frontier towards the northern portion of the land, whence they kept watch and ward over the subjugated district.

In the year 1824, and while the general condition was that which has been described, a few Englishmen came from the Cape and settled as traders upon the coast, slowly gathering about them a small following of the old gentle people of the land, who had been scattered in all sorts of hiding-places. These traders entered into *quasi* friendly relations with the Zulus, who were in all probability influenced by considerations of anticipated gain, and occupied land under a sort of permissive treaty and countenance accorded by the Zulu chieftain. In the year 1836 a party of Dutchmen, who had taken offence at some regulations enforced by the English Government in the Old Cape territory, found their way to Natal, and came down into it through the inland mountain frontier. These Dutch visitors took a great fancy to the land, and claimed it by "nine points of the law:" that is to say, they sat down upon and took possession of it, apportioning it out among themselves in pleasant allotments of 6000 acres a-piece. The Zulus, however, did not altogether take to these new neighbours, and a period of struggle and conflict followed, in which war was waged for some time with varying success; but which at length terminated in the Dutch beating back the Zulus beyond the great river Tugela, to the north. Then the English Government claimed the Dutch settlers as subjects, and in its turn took possession of the land. The Dutch at first resisted this claim in arms; but when they found that the English Government was in earnest, at length made a virtue of necessity, and in part "trecked" away in disgust over the northern frontier, and in part submitted to English rule: on the 5th of July, in the year 1842, that is now twenty-six years and a-half ago, Natal virtually became what it has since remained—a Colony of Great Britain.

In the short period of time which has elapsed since Natal was the seat of Zulu Savagedom and of Africander Dutch Boerdom a very remarkable change has come over its spirit and prospects: where there was so recently nothing to be seen but a commercially unproductive wilderness, and herds of cattle scattered broadcast over the natural pasture, there are now wide stretches of plantations of sugar and coffee extending themselvss rapidly year by year; and, strange to say, the food crops of temperate climes, and sheep and horses mingling with the cattle, and almost looking down upon the tropical produce. This eminently interesting result is due to the combination of a remarkable series of natural circumstances, which it is the object of this communication briefly to describe.

The land which is thus recognized as the British Colony of Natal lies on the South African coast of the Indian Ocean, mainly included between the 28th and 32nd parallels of south latitude, and approaching in its northern part to within 220 miles of that spot on the earth where, in the midsummer of the southern hemisphere, the sun shines down vertically upon the ground at the hour of noon; its northern point is excluded from the southern tropic scarcely more than 200 miles. The great African Continent is reared to a considerable height above the sea in this region. It is a mighty table-land mass, some six or seven thousand feet high. But this lofty table descends to the sea, for the most part, by a bevelled rim or sloping ledge, that subsides from the lofty elevation of the general surface by a gradual fall, until it finally dips beneath the ocean. Natal is entirely included within this seaward slope. It is a strip of territory 150 miles long, and from 120 to 160 miles broad, backed by a mountainous bulwark, really the abrupt edge of the higher table, where it begins to descend, and faced by the ocean. The landward frontier of the Colony is called the Drakenberg Mountains. From the lower ground of the Colony this landward frontier, or bulwark, looks like a true range of mountains; but it is really an abrupt and broken ledge—a sort of first step by which the great central table begins to break away in its descent to the sea. The general range of the edge of this step lies about 6000 feet above the sea. But it is not an even piece of masonry. It is peaked and jagged; the peaks and jags rising in exceptional cases to between eight and nine thousand feet high. This peculiarity, of course, completes the illusion in the matter of the mountain range, and leaves the eye of an observer impressed with the sense that it is looking at a wall, which must have a further, as well as a nearer, side.

The mountain frontier of the Colony, however, does not lie exactly in a straight line; it is not absolutely parallel to the direction of the coast. It traces a bold zig-zag, which is some 30 or 40 miles nearer to the sea in one place than it is in others; thus giving an irregular breadth to the slope of land which constitutes the Colony. From the advanced, or salient angle of the zigzag, there issues a bold mountain spur, which crosses the entire central district of the Colony, at the distance of 70 miles from the sea, until it strikes the north-eastern frontier, formed by the large river Tugela. The high road from the port and capital into the interior traverses this central hill region at a height of 5400 feet above the sea; and the hills that surround the pass rise some hundred feet higher. This central highland is, in reality, the key of the physical geography and meteorology of the land. Towards the sea this central mass fingers away into sinuous ridges, which have all separate and distinct rivers draining from the grooves lying between, and emptying themselves, each by its own proper mouth, into the sea. Landward, the central mass looks into a broad depression or basin, more than one-third the size of the entire area of the Colony, and which is drained by a single river system. The multitudinous streams of this river system are all gathered into one channel on the north-eastern frontier of the Colony, some 70 miles from the sea; from which one large river, the Tugela, flows through a ravine into the ocean. This inland river basin is not properly a basin in the limited sense, which implies an even or hollow depression. It is formed of successive hills and valleys, broken country, like the rest of the land; but it is everywhere country in which the hills do not rise to the elevation of the great central masses, and from which the waters run to one common gathering-point. Up to the central region the climb is, more or less, continuous from the sea; but beyond the central region the climb ceases, and the tracks and roads really descend, not again to reach the same height until they finally scale the frontier barrier of the Drakenberg.

On reconsidering the remarkable physical configuration of country which has here been described from a geological point of view, there very soon arises the perception that the surface masses of the great Continental table are of a younger date than the rocky substance of the rim, where that dips away beneath the sea. It seems very much, indeed, as if there had been a vast layer of horizontal pavement, or sedimentary, and therefore stratified, rock spread out to an enormous distance, and that then masses of this horizontal pavement had been rudely knocked away all round the outline which now marks the form of the most elevated portion of the table, baring the underlying foundations upon which the masonry of the horizontal pavement had been spread. As the observer descends from the high region of the Drakenberg frontier of Natal, through the Colony towards the sea, he gets more and more into the region of the old crystalline rocks, granite, gneiss, and their congeners. He sees that the bevelled rim of the great table mass, which constitutes the Colony, is really formed by the chipping and knocking away of the upper pavement there, until the lower foundations are bared and brought to the light of day. But as he moves along to make this survey, he comes continually to spots where isolated fragments of the upper pavement still stand reared majestically around, and he passes between them in vast and mighty gorges, which have been scooped out in some way, either by the disruptive force which has shattered the pavement, or by some subsequently acting agency. These isolated fragments constitute the table mountains, which are so familiarly known as characteristic features in South African scenery. They are all broad slabs of horizontal sandstone, three or four miles across, and some hundreds of feet thick, upreared upon ridged buttresses of granite or gneiss, which descend as steep green slopes into surrounding valleys of great depth; the edge of the superincumbent sandstone being clear and bare, and being seen to be scored into distinct terraces, when the reflective rock is lit up and painted by the bright sunshine, so effective in bringing out the characters of structure and relief. These table mountains are all of them, more or less, connected with the leading ridges which come out from the frontier mountains, or ledge of primary disruption already spoken of, although at their very summits their sandstone sides are precipitous walls for at least some hundreds of feet all round. Many geologists conceive that the grand gorges which lie between these upreared table masses and the system of connected ridges are mainly the work of denudation, the hollows of the valleys having been worn by the sucessive torrents of unknown and unrecorded ages. It is obvious that these vast valleys of Southern Africa have been marked to a considerable extent by the eroding and sculpturing power of water. But it is exceedingly difficult, in riding through this land, and measuring the dimensions and spaces with the eye, to realize the conception of the adequacy of such an agency to the work that has been performed. The writer must frankly confess that he has never been able to do so; and that, in making the attempt, he has invariably found himself lodged in the growing conviction that the mighty gaps have been primarily struck out by the disrupting agency that has shattered the sandstone pavement, and that the fragments of the shattered pavement have been partly dragged asunder by the yawning of the chasms and cracks, and partly swallowed up in the flood of molten rock that has burst through the intervals from beneath, fusing and recompacting the substance of the now missing fragments into metamorphic forms, and turning them again into slates and greenstone, and even into granite and gneiss, when circumstances have allowed of the re-crystallization.

Trap and granite appear to have shared between them the task of upheaving the hills of this portion of South Africa. Granite, in one or other of its Protean forms, is encountered continually along the lower and midland range of country. Huge blocks of the bare rock stand out on the hill sides in grotesque relief; in many places upon the coast the white surf breaks over rocks of granite that extend for miles along the shore, and are painted of the brightest and most varied hues by the combined influences of the water and the sunshine. The trap appears everywhere and breaks through everything. Now it assumes the form of basaltic columns running out "Giant's Causeway-like" into the sea. Now it is a straight black wall, cutting its way clear for long distances through the tumbled chaos of the granite rocks. Now it is a vertical dyke, splitting granite, and slate, and sandstone precipices; and now it is overlying hills of hard greenstone, peppered with rough round blocks of the same substance, that seem to have been scattered over the surface while the rock was in a semi-plastic slate. The sides of the hills and the bottoms of the valleys are in many places masked by layers of dark shale, occasionally baked almost into the condition of slate, which seems to have been primarily derived from the washings and disintegration of the greenstone, and to have been subsequently more or less hardened and compacted into their present condition. Much of the productive surface-soil is formed by the further disintegration of these shales, under the combined influence of the atmosphere and vegetable life. Sandstone is, upon the whole, more abundant than the granite. It occurs with the granite on the coast, often forming sea-cliffs. The rivers in all directions run through gorges, between walls of sandstone, and often leap from lofty ledges of it by bold cascades. There are fine samples of building freestones to be had in all directions. The watershed of the great upland basin of a single river, already described, is one broad stretch of carboniferous sandstones and shales, broken and shattered by intrusive trap. Beds of coal are there encountered in various places, cut through by the water-courses, and showing themselves in the hill-sides in sections many feet thick. This coal is now in general use by the blacksmiths of the Colony; it is of excellent quality for various purposes; it burns well in the domestic grate, and it yields an abundant proportion of brilliant gas. It is anticipated that much of it will prove to be suitable for the furnaces of steam machinery; but on account of the distance at which the chief deposits lie from the coast, and the difficulty and cost of transport in a land where all heavy carriage has to be effected by ox-waggons, no sufficient trial of its character in this particular has yet been made; carboniferous deposits have also been found on the seaward slope of the great central high land, and in places upon the coast itself, as near the mouth of the river Umhlali. But present appearances seem to indicate that these are all valueless carboniferous slates, of affinity with the lower coal-measures of England, rather than with the more valuable upper coal; while the great upland basin seems rather to be a true coal-measure in the latter sense. Limestone, which is one of the rarest rocks in Natal, has been discovered underlying the edge of this upland basin at its south-western border, just above the Mooi River.

It must, however, be here stated in general terms that there can be no certain assurance yet that even valuable coal-measures may not be hereafter discovered in the coast region of Natal, for the great law of South African Geology is confusion and disorder, rather than order and rule; anything Geological may be stumbled upon anywhere. The whole series of rocks is so tumbled, and twisted, and turned, and mingled up together in inextricable complexity, that no doubt many things not at present known will hereafter be discovered where they were least expected to be. After many years of belief that there was no lime in Natal, excepting what could be procured from coast deposits of shells, a large mass of some twenty square miles in extent of white metamorphic crystalline marble, almost like that of Carrara, has recently been encountered. At one spot a tributary stream of the river Umzimkulu flows beneath a precipitous wall of this white marble some thousand feet high; just beyond the extreme southern limit of the Colony, on the coast, there crops up in immediate succession to granite and old Silurian Sandstone a limestone deposit filled with organic remains, which seem to indicate that it is of the age of the European Oolite at the oldest, and possibly of still younger date. The foot at low water wanders along upon a pavement of this limestone, in which these organic remains are seen embossed upon the wave-worn surface. The sea cliff is hollowed out by the breakers into caverns, where they lie thick both on the ceilings and walls. These organic remains comprise among them gigantic muscles, or pinnæ, three feet long; and well-known forms of ammonite, terebræ, trigoniæ, and a long spiral shell closely resembling the chemnitzia.

Little is yet known of the mineral wealth of this region. From the general constitution of the country there is fair reason to assume that ores of the useful metals will be found in the veins of its old igneous rocks when these are intimately examined. Pockets of promising copper ore have recently opened out in two or three places along the coast. Ironstone abounds in many of the midland districts. It has to be dug out from the ground in and around the city of Maritzburg to get sufficient depth of good soil for the gardens.

The climate of this Colony is of course primarily dependent upon the immediate influence of the sun. The region is so placed in regard to parallels of latitude, that the central portions of the land are within about 400 miles of the spot where the sun shines down vertically upon the ground at noon in the season of midsummer; that is, within 400 miles of the Southern Tropic. During the months which are the nearest to this period, and which may be taken as the summer months of Natal, namely, from October to March, the heat derived from this source is very considerable. The mean temperature of these six months, at a height of about 2000 feet above the sea, is 69 degrees; the mean temperature of the hottest month of this series, namely February, is 71·8 degrees; the mean temperature of the coldest month of the series, namely, October, is 66·6 degrees. Upon exceptional occasions, when the hot land-wind blows in force, the air temperature rises to between 86 and 97 degrees. The hottest air temperature marked by self-recording instruments, during a period of eight years, was 97·6 degrees.

Now, the temperatures here indicated are quite enough to convert the land at this season into a scorched desert, if there were no counterbalancing agency in play. But fortunately, in the case of this favoured region, nature has provided a counterbalancing agency of a very remarkable kind: during the season of greatest heat nature draws sun-screens over the land as soon as the sun is well up in the sky, and brings out her watering-pot and drenches the ground, turning her streams just as the gardener does, now on this side, and now on that, in all directions, until the earth is well saturated everywhere.

The instrumentality by which this most important and beneficent result is insured has now in the next place to be described:—

In the account of the physical configuration of the land, which has already been given, it will be remembered the Colony has been spoken of as the bevelled or sloping rim of the great table land of the African Continent, running down from a height of some 6000 feet, until it plunges beneath the sea. Now, when the nearly tropical sunshine falls upon this broad land-slope during the days of the summer months, the air gets so heated that it acquires a general tendency to rise along the slope: in other words, it is driven in and up by the greater pressure of the cool sea air, and in this way a strong and steady sea breeze is established. A further cause is also at this time, it must be understood, acting powerfully to determine the motion of the atmosphere in the same direction. The south-east trade wind quite affects this portion of the earth at the season when the vertical noon-day sun comes furthest among these southern parallels of latitude. From the combined operation of these two causes it is found that, in any long series of evenly distributed observations, the wind is blowing six times off the sea for once that it is blowing off the land. Now, a sea wind is, of course, a moist wind, in the sense that it arrives upon the land carrying with it as large a burthen of invisible vapour as it is able in existing conditions to bear. If in this state it blows in upon yet colder land, it at once deposits some considerable portion of its watery burthen; but if, as in the case of Natal, it blows in upon a *warmer* land, it acquires increased power of sustaining its moisture. Here, then, a yet further expedient has to be contrived to make the water fall from the air to the ground.

The expedient is briefly and simply this:—As each day advances, the land-slope gets more and more hot under the strong sunshine, and the *upward movement* of the air becomes in like degree more and more energetic, until at last it is converted into an actual upcast, like the upcast in a strongly heated chimney. A large volume of greatly heated air suddenly flies up like a vast balloon; as it rises, it gets where more and more of the overlying pressure is escaped from, and so, of course, swells and expands, and as it does so, in consequence also becomes more thin and rare, and more cold. In this rarified and chilled state it is no longer able to uphold all its original burthen of invisible vapour. The vapour consequently appears first as thick cloud, and soon after as heavy and drenching rain; and as the rain falls, electric disturbance is simultaneously brought about, and the rain becomes a violent thunderstorm.

The operation of this agency is so constant and steady, that in any one place rain falls on almost every second day, on the average, during the six months of greatest heat. In all probability it falls somewhere every day; but it is in the nature of these violent upcasts and thunderstorm disturbances to limit themselves within a certain range, and to prevail now on this side and now on that. About 24 inches of rain are thus scattered on the ground in Natal, at an elevation of 2000 feet above the sea, during the six months of summer. At this season, therefore, all scorching and parching is summarily prevented; such a thing as drought is entirely unknown. The rivers are always full. From October to March an average fall of four inches per month, and the occurrence of rain on fifteen days in every month, may be looked for. The actual distribution of the rain-fall through the several months, taken as an average for a period of eight years, is, for—

October, ...	3·60 inches.	January, ...	3·92 inches.
November, ...	4·58 „	February, ...	4·41 „
December, ...	5·04 „	March, ...	3·29 „

The extremes of temperature are less upon the coast than upon the uplands, that is to say, there is less scorch in the sunshine of midday, and less freshness in the night. But the mean temperature is about four and a-half degrees higher than that of the neighbourhood of the city, 2000 feet high. This result, in itself a natural and well-understood consequence of elevation, is in some degree aided by the direct heating power of the sun being supplemented by a kind of hot water apparatus. The inshore currents of the ocean in these latitudes set down mainly from the lower latitudes of the neighbourhood of India toward the Cape. Some of the superfluous warmth of India is in this way transported to the shores of Natal for the service of its coast conservatory. Nothing is yet *absolutely* known of the extent to which the coast climate of Natal is influenced by these warm ocean-currents flowing from the lower recesses of the Indian Ocean; but in all probability the influence is more negative than positive—more protective from the action of vicissitudes and incidental chills than actually cumulative. If the sea temperature in these currents were sufficiently high to act very positively upon the mean temperatures of the air, the probability is, that there would be a great dearth of fish in the waters. This certainly is not the case. The inner bay is at all times teeming with fish in enormous numbers and in immense diversity.

It will be readily conceived what the immediate consequence of this combination of abundant and never-failing watering with high temperature must be, so far as vegetation is concerned. All vegetable growth is stimulated into most energetic activity. The coast and the lower regions, which are most essentially the conservatories, are clothed with tangles of luxuriant evergreens, and during the summer season of frequent rain, the land is verdant from the sands of the sea to the summits of the mountains. The abundance of rain during the hot season, however, has another most important effect besides this support of luxuriant vegetation—it tempers and softens the heat. Very soon after midday, during the summer months, thick clouds are drawn over the earth, and kept there until the sun has plunged beneath the horizon; then, when the cloud screen is withdrawn, vigorous evaporation from the saturated earth carries on the cooling process. This in reality is why it is that a land lying mainly within the 30th parallel of latitude boasts a yearly mean temperature of 64·7 degrees at an elevation of 2000 feet, and of little more than 69 degrees at the sea-level, and extremes of heat that scarcely rise above those occasionally experienced in England. The heat is, so to. speak, transmitted into vegetable energy, instead of being left as free and accumulating caloric. In this approximately tropical country there are not more than fifty days in the year in which the temperature rises at the city of Maritzburg to 84 degrees, and not more than twelve days on which it rises to 90 degrees. There are only about eight nights in the year on which the temperature does not fall to 70 degrees, and there are 200 nights in the year on which it falls to 60 degrees.

In the opposite, or winter season of the year, nature seems in this region to be as careful and economical of sunshine as in the opposite season she is prodigal of shade and of moisture. The same general agency is kept in operation, but in a much less energetic form, as if in this way modified to meet the new need. The land-slope is warmed, the moist sea breeze maintained, and in the late afternoon clouds are heaped up round the tops of the highest hills and mountains; but the strong atmospheric upcasts are not established, and the thunder storms only developed at rare intervals. The rain-fall at 2000 feet of elevation, for the six months intervening between April and September, is six inches in the place of twenty-four. During each of the two midwinter months only a quarter of an inch may be looked for, and rain may be expected on only three days. In the months of May, August, and September, rain may be expected to fall on eight days, and nearly one inch and a half may be looked for in each month. The exact rain-fall of these dry months, on an average extending through eight years, at an elevation of 2000 feet, is—

April,	1·44 inches.	July,	0·28 inches.
May,	0·95 „	August,	1·14 „
June,	0·26 „	September,	1·32 „

The months of May, June, July, and August, are periods of almost uninterrupted sunshine. The midwinter June of Natal very nearly resembles an exceptionally fine midsummer June in England, excepting that the longer nights of fourteen hours' duration are fresh and cold. The mean annual temperature for these six months is 60 degrees, at an elevation of 2000 feet, and nearly 65 degrees at the sea level. The temperature commonly rises to 70 degrees each day. There are only eight days in the year on which the temperature does not rise to 60 degrees, and scarcely twenty nights in the year on which it falls below 40 degrees. The self-registering instruments only marked a freezing temperature, at the height of 2000 feet, five times in a period of eight years, and the greatest cold in that period was 29 degrees.

After the midwinter season the grass gets coarse and dry, and the face of the country would be russet and brown, if it were not that it is made black instead, by the prevalent custom of burning the dry herbage. The rivers and water-courses, however, never dry up. There is always enough mist on tho hills, in addition to the rain that does fall, to secure this. Deciduous trees, like the white mulberry, are not more than six weeks bare of leaves. The gardens are easily kept full of bright flowers all winter long, and food crops can be profitably reared throughout the winter months by the judicious employment of irrigation.

It is worthy of remark that this distribution of the warmth and moisture in the opposite seasons of the year is in direct contrast to that which prevails at the Cape of Good Hope, 800 miles further to the south-west. The Cape of Good Hope notoriously enjoys what is considered a very beautiful climate; but its excellences do not at all bear comparison with the excellences of the climate of Natal. The Cape has its chief rain-fall in the winter months, in association with its greatest cold; and its chief dryness in connexion with the heats of summer. The effect of this contrast is very striking when the traveller passes directly from Cape Town to Natal in either season. The impression made upon the senses is very much like suddenly entering a well-kept luxuriant garden.

The sugar cane, the banana, and the pine apple, flourish in the coast region of Natal, but none of them are found at the Cape. The orange is common to both. The vine, which is at home in the dry summer of the Cape, does not do well in Natal, without artificial care and protection, on account of the wetness of the summer. The observer, in passing through the coast district of Natal, now traverses large stretches of sugar cane—about 6000 tons of sugar are annually exported from the colony, although the cane was an experiment there twenty years ago. The observer also encounters young plantations of coffee extending in all directions. The coffee grows to perfection all along the bush-land slopes of the coast, and in some of the oldest plantations yields 800 lbs. of berry per acre. Arrowroot is grown and manufactured in the same districts to the extent of about £6000 value in the year. It is a great favourite with some planters on account of requiring very little capital, and doing well in soils that are not up to the mark of producing sugar and coffee. Tea grows and flowers with great facility in the same grounds as coffee, but it has not been planted in sufficient quantity to be turned to commercial account. Tobacco will certainly before long be a valuable export from the colony. It thrives well in the coast region, but is by no means limited to that range. There is also the highest degree of probability that silk will be successfully and remuneratively produced. The white mulberry grows with incredible luxuriance and readiness. It is already naturalized everywhere. No large experiment has yet been made with the worm; but a gentleman used to its management in China is just gone to the Colony fairly to try what can be done with it there. Cotton, to the value of between £5000 and £6000, is now produced in the year. Hitherto it has been chiefly grown on the coast, and has not been found to do well there, because it lengthens out the period of its flowering, and makes a troublesome harvest, and because it seems to be liable in that position to the ravages of insects. It has, however, now been ascertained that these difficulties are not experienced at higher elevations. The coolness of the nights in the winter season seems then to apply just the corrective that is needed for the desultory habits it takes upon itself down below. It should be, perhaps, added here that a conviction is slowly arising that even the coffee plant will do well at elevations that are far above those which were first contemplated for it. It has recently been found to ripen its berry with certainty in the neighbourhood of Maritzburg.

When the traveller advances from the coast inland, he leaves the region of the luxuriant ever-green bush, of the sugar-cane, the pine apple, and the banana, at a distance of about sixteen miles from the sea, where he finds himself on land at an elevation of 700 or 800 feet, and he there enters a hill region of fine bare pasture, and he stumbles continually upon homesteads that are surrounded with flocks of sheep and herds of cattle; and that grow oats, wheat, and green-food crops, such as belong properly to the farming operations of temperate climes. This change is of course due to the elevation of the country. The influence of rise above sea-level in lessening temperature is too well known and understood to need special exposition here. Every one is aware that the lofty mountains of even low, hot latitudes, are capped with eternal snow. It has been seen that at the city of Maritzburg, 54 miles from the sea, and 2000 feet high, the mean temperature of the year has fallen four and a half degrees. Further on among the hills of the great central highland it declines still more. An old colonist, who has lived for some years in this high region, says of it: "The climate here is most agreeable and bracing. In the winter we have occasional snow storms, and I have once or twice seen the snow more than a foot deep. We have frost almost every night for three months, more or less. Even during the summer the heat is seldom, if ever, oppressive. I have never known a hot night; and during a period of ten years I have never been more than twenty nights without a fire in the grate of an evening." Even the midland districts, which lie about the city of Maritzburg, are well adapted to the pursuits of mixed farming; but the most valuable grazing grounds are found still further in. The general range of this hill country is either open and unsheltered pasture, or grass land thinly covered with thorny minosas. On the sides and tops of the higher mountains forests of evergreen trees re-appear, many of them yielding very valuable timber, chiefly of the yew, laurel, horse chestnut, and olive tribes. In the midland and upland region the gum trees of Australia (species of evergreen myrtles) are now extensively planted, and are deservedly very great favourites. They grow with incredible rapidity, commonly attaining a height of twelve feet in the first year. There are gum trees in Maritzburg which were planted within seventeen years which now measure eleven feet and a half round near the ground, and which are 120 feet high.

Cattle have long been successfully reared on the high pasture grounds of South Africa. The Dutch boers of the past generation have been mainly dependent for their prosperity upon their herds. In this respect Natal stands in quite as good a position as the best of the neighbouring lands. The Dutchmen, who first came down into it through the frontier mountains, brought their oxen with them in large numbers, and these have multiplied in the land until they are now counted by "hundreds of thousands" (300,000). The luxuriant grass of Natal is eminently suited for the production of beef. Draught oxen, that have been worked a dozen years in the yoke, and that are little else than skin and bone, if turned out for the summer on some of the best pastures, may be sent to the butchers in the Autumn as fat and heavy as if they had been stall-fed in England. *Grass-fed* slaughter oxen are commonly met with weighing from 800 to 1000 lbs. In the early years of the occupation of the colony the cattle multiplied so fast that there was great probability of their soon coming to be killed for hides and tallow; but about fourteen years ago the epidemic lung sickness appeared among the herds, and from that time the increase was checked, and the prices and value considerably raised. The disease has now almost entirely disappeared, and the prices of cattle are again steadily diminishing. Sheep are also now thoroughly established upon the upland pastures. Before the year 1855 the only animal at all resembling a sheep that was known in Natal was a brown hairy creature belonging to the natives, properly a variety of the Siberian Goat or Mouflon. In that year the Dutch boers, alarmed at the progress of the lung sickness among their cattle, determined to endeavour to have two strings to their bow, and brought a quantity of half-bred sheep over the mountains. Now almost every upland farmer in the Colony is more or less a flock-master. The sheep, however, do not thrive equally well in all localities, or under all hands; they require a high elevation. But that is not all they need. They want also good drainage, a porous, unretentive subsoil, and suitable grass. The rocks throughout the colony are tumbled about in such a welter of confusion, that the character of the subsoil varies considerably within even narrow limits of range. Spots that are unexceptionable for flocks lie side by side with tracts that are as unsuitable. It also needs to be understood that the natural grass of the Natal pastures is so luxuriant during one period of the year, that it is capable of supporting many sheep to the acre; while at another period of the year it is so dry and coarse that many acres are required to feed one sheep. In all probability sheep farming in Natal will finally settle down into the rearing of comparatively small flocks of good breed in connexion with the general tillage of the soil, as in England, rather than in the running of large flocks upon the open prairie, after the fashion of Australia. Natal is not a pastoral land in the Australian sense; but where the mixed system of farming is judiciously pursued, artificial food provided, and due skill and care exercised in the selection of the farm and the management of the animals, sheep prove a most important element in the settler's prosperity. The Angora Goat, too, thrives perfectly in many of the localities which, for reasons glanced at above, are doubtful for sheep.

Horses are bred in some of the upland farms of Natal with marked success; they are attacked with a fatal epidemic disease on the low-lying lands of the coast. An export trade is just beginning with India; Natal horses are being shipped to Bombay as cavalry remounts. The Natal horse is an offset from the old Cape breed; he is a hardy, courageous, and enduring animal. In military service the Natal horse carries 17 stone thirty-five miles a day, with an allowance of 10 lbs. of Indian corn in addition to the grass. There are instances in which Natal horses on military service have performed a march of ninety miles in twenty-five hours, carrying 17 stone, without suffering fatigue or injury.

Wheat grows readily in the uplands, and is, of course, a most welcome addition to the farmer's resources. It is, however, liable to rust on account of the wetness of the summer. This evil can be almost certainly avoided by growing the crop so as to harvest it in the dry winter season, by the use of artificial irrigation. Oats and barley are more easily handled than wheat. The potato, the turnip, and the beet-root grow very much as in England. Indian corn is the great grain staple of the colony. It thrives everywhere, low and high, but it bears its best crops among the hills. It is the principal food of the natives. Three pints per day of the meal suffice to keep a full grown man in vigorous health. It is, however, equally valuable as food for animals. Horses do well with it; cows keep in milk upon it through the scarce period of winter, and pigs fatten upon it with surprising rapidity.

It has been stated that the pine apple, the banana, and the orange are found in the gardens of the coast in the greatest abundance and in the most complete luxuriance. Pine apples grow round Durban as turnips grow in English fields. The upland gardens present curious shading away of the subtropical into the temperate. The loquat of the Eastern Islands, the granadilla of the West Indies, and the fig of the South of Europe there mingle with the peach, the apricot, the nectarine, the apple, the mulberry, and the ordinary garden vegetables of England, from the lettuce to the radish. Gourds in every variety, from the melon to the cucumber, are in full force, and the tomato ripens into remarkable excellence.

The harbour of Durban—the port of Natal—is the only natural haven that occurs along the south-eastern shore of Africa. It is a land-locked basin of still water, about ten miles in circumference, with a sea outlet that is of varying depth, in consequence of the presence of a shifting sand bar, which is sometimes heaped up by the breakers, and at others scoured away by the tide. Vessels of moderate burthen can always find access to the harbour, unless upon the rare occasions when dangerous breakers are rolling over the bar under the influence of a southerly gale. But vessels of larger size have often to be lightened at the outer anchorage, or to wait for favourable opportunities. The average depth of water upon this bar at high tide is about nine feet and a half, but the depth varies at different times and seasons between eight feet and seventeen feet.

The land-locked harbour of Natal is a portion of its physical geography. It is due to a very remarkable and interesting configuration of the land at this portion of the coast. A bold range of sandstone hills, nearly 300 feet high, comes along the shore from the south-west, and then suddenly terminates in a fine sea bluff, which is lashed by the breakers. Further inland a second and similar range of hills, known under the name of the Berea, runs parallel to the bluff range at a distance of about five miles from it. The inner range also strikes the coast five miles further to the north-east than the bluff, near to the mouth of a large river, the Umgeni, which there empties itself into the sea. Between these two parallel ranges there is thus a low valley looking out seaward, towards the south-east. But the mouth of this valley is closed from the sea by a low spit of blown sand, which is piled across from the outer range of hills near its bluff extremity to the inner range. This sand has obviously been brought there by the sea currents settling along the coast, and has eddied in round the bluff, and so been entangled as it were behind its shelter. The sand spit is, however, not quite complete; it stops short just before reaching the bluff, and leaves a gap of a few hundred feet; that is the sea opening, or outlet of the harbour. The low space lying between the two parallel ranges of hills, behind and within the sea range, and thus nearly enclosed seawards by the sand spit, is partly a flat of accumulated sand, and partly still water. The sand is the plain upon which the town of Durban and its suburbs stand. The water is the inner harbour sheltered from the sea by the bluff range, which stands as a high barrier before it. Two small streams of fresh water run into the harbour. But its water is almost entirly tidal and derived from the sea. The tide rises and falls in this part of the ocean about six feet, and as it does so the water flows in and out of the land-locked basin, more or less scouring the natural channel, and keeping the sea outlet from being closed by the increasing deposit of sand.

The sand which forms the cross spit, and the flat included plain, and which indeed is heaped up abundantly all along this sheltered nook of coast lying under the influence and shadow of the bluff, has been to some extent supplied by the rivers that open out along the coast, and more particularly by the Umgeni, the large stream lying within a very few miles to the north-east. It has, however, been heaped in the position which it now occupies by the currents and breakers of the sea. The great natural forces which have been concerned in its deposit can still be observed in continued operation. Whenever the sea is more than usually boisterous, and heavy sea rollers prevail, the sand is rolled up and in augmented abundance, the bar across the outlet is increased, and the tidal outset from the inner basin wages an unequal conflict in its attempt to scour away the accumulating incumbrance. In fine and still weather less sand is piled round, and the scouring water acts at a greater advantage in clearing away the deposit, and then the depth of the water over the bar at the sea outlet of the channel is increased.

Some six years ago extensive works were commenced, to remove this capricious and shifting sand-bar out of the domains of nature, and to place it within the fixed and orderly control of art. It was then proposed to extend two sea piers of timber and stone, one from the bluff point, and the other from the opposite sandpit, until they completely enclosed the present position of the bar, and reached into deep water, and so to forbid the further accumulation of sand under sea currents and breakers at this spot, after the sand-bar has once been scoured away under the impetus thrown upon the narrowed outlet. The piers were at first constructed under a plan devised by Captain Vetch, and consisted of timber frames, which were put down, ready tied together, in their place, and were then loaded with stone, on the bluff side, where a ledge of rugged rocks run out into the sea in continuance of the line of sandstone hills, and where the exposure to the rollers is of the most unfavourable character; it was, however, soon found to be quite impossible to carry out this design. The frames of timber were continually knocked to pieces by the breakers before they could be got securely based and fixed. At the present time, therefore, the pier on the opposite side is being carried on in a modified form. Piles are now driven down into the sand, and masked on each side with mounds of stone rubble; and it is anticipated that when certain false channels have been closed by this proceeding, and a narrowed outlet formed, so that all the outflow of the current must tell upon the sand of the bar, it will be found that the outlet of the channel will have been sufficiently relieved of its shifting incumbrance, to secure such facility of ingress and egress as is required for the purpose of commerce. A railway has now been laid down from the works to a convenient and suitable quarry of stone, and the construction is being carried on under the direction of the Colonial Engineer, at a rate which will enable the capability of the work to accomplish this most desirable object to be fairly tested within a couple of years from the present time.

XXII.—*On certain Woods and Timber Trees of New Zealand.* By William Andrews, Esq., M. R. I. A., Chairman of the Natural History Committee, Royal Dublin Society.

[Read 18th May, 1868.]

Some few months since, I had the honour of submitting to the members of this Society a paper "On certain Branches of Industry, with special reference to the Steps taken by the Royal Dublin Society for their Promotion." In that paper, I endeavoured to show the past position of the Society, and the different stages of progressive improvement that had been accomplished in this country through the means and exertions of the Society. Of the several branches of industry, or of important improvements to the country, I had referred to the reclamation of bog lands, and to the introduction of useful timber trees, and also to ornamental planting, for which the state of the climate of Ireland, and its soil, I considered to be peculiarly favourable. In the introduction of hardy trees from other climes, whose temperature does not vary much from our own, a knowledge of growth and locality of the trees in their native land is essentially necessary to the selection of sites; and which, with proper drainage, must be attended to with judgment. Often do we see plantations stunted in growth, and pines with withered leaders, after having been a few years planted, from such conditions being neglected, or not understood. On the other hand, where sound judgment is exercised, plantations luxuriantly thrive, which may be seen at Glencar, near Hazlewood, Sligo, where—although exposed to severe gales from the Atlantic—by judicious drainage and planting, through the direction and care of the late Right Hon. John Wynne, the Pines, the Oaks, and the Elms have vigorously grown.

Before submitting to the meeting some of the woods of New Zealand—several of the most important timber trees in that country—I will give a few extracts from practical observations made with reference to its climate. Dr. Dieffenbach, Naturalist to the New Zealand Company, and who, more than twenty years since, explored various parts of those islands, and contributed much to the knowledge of the Geology, Botany, and Natural History, states that, on reaching New Zealand, the land was made on the 16th of August, to the southward of Cape Farewell, on the middle island. The land seemed to consist of a chain of steep snow-capped hills, running through the middle of the island, and rising in a succession of ridges from the sea shore. "On the northern island we saw the mountains of Tararua, in the neighbourhood of Port Nicholson (Wellington), also covered with snow. At a further distance, in a nearly central position, a bulky snow-covered mountain appeared, which proved to be Ruapahu. The Rimutaki

Mountains, near the Wairarapa Valley, were also covered with snow. Amphitheatres of hills are covered with a primeval forest; and high up the sides of the hills are clothed with trees belonging to the Pine tribe, of which the *Rimu*, *Totara*, and *Mai* are most common, and obtain the greatest thickness. The district near Wairarapa, not more than forty miles from Wellington, where the Tararua range extend, is clothed with wood. The mountains do not exceed 3,000 feet, and are covered with snow during the winter season. The woody region reaches nearly to their tops, and, in many cases, the hills are covered by forests." I give these remarks, as the woods that I shall describe this evening are from those localities. Perhaps more recent observations in connexion with that part of those islands may be interesting, which I give from a communication made to me by Colonel Dwyer, who, in command of a division of Her Majesty's 14th Regiment, had spent seven years in New Zealand in winter and summer campaigning. He took great interest in observing the states of climate, and the vegetation of New Zealand, especially with regard to many of the more useful timber trees. He writes:—"I do not see why most of the forest trees of New Zealand should not flourish in Ireland—at least as far as climate has to do with them. There are some that require a more sheltered and mild temperature—as the Kouri Pine, and the Kakatea; but the Rimu, Totara, and those that flourish, and grow to an immense size on the Wairarapa range, near Wellington, and on the Kaikora ranges, in the middle island (upon the summits of the latter there is perpetual snow), ought to thrive in Ireland. The heart of the Totara is one of the most lasting woods in the colony, and is used for piles for wharfs, &c., as exposure to water or air has no injurious effect upon it. It is frequently attacked by the Ratta (as also other Pines) a species of Myrtle, with a red blossom, similar in shape to our white Myrtle. This parasite is of rapid growth, and twines itself spirally round the Totara, until the Pine is perfectly encased, and, eventually, the Ratta becomes the tree. When growing in dense forests, the trees reach to a considerable height, and bear severe changes of weather; but when singly grown, or planted, the furious gales of wind that frequently occur destroy all ornamental planting. I had great experience of the climate of the different parts of the north island, having served a greater part of the Waikato campaign (without a tent for a month) in the summer, and did not suffer; but, in the month of May, we had snow and ice; and, in the winter campaign, on the west coast, we had very severe weather—sleet, snow, and hail, and not the weather to make a bivouac agreeable. Now, my opinion is, that if the trees in those different parts can stand the cold in their native land, there is no reason why they should not thrive in Ireland. I sincerely hope that your good intentions as to general improvement may be attended with success." Colonel Dwyer has given me a very interesting statement with reference to a portion of the province of Wellington, furnished for the information of General Cameron, which will be given in the Journal of the Society.

In referring to the Pines—many of which are beautiful—the most useful are the Rimo, Matti or Matai, Kauri, Tatara, Remu, and Kahikatea; these, with the exception of the Kauri, are hardy, several growing at great elevations. The Totara of the natives is the most valuable timber tree in New Zealand. The wood of the Totara (*Podocarpus totara*) is most durable and imperishable, never decaying, no matter how long immersed in water, or exposed to the air. From its lightness and durability, and the great bulk it attains, the natives prize it for constructing their canoes. It grows at some elevation on the hills, attaining a height of eighty or ninety feet, with a circumference of fifteen to twenty feet. It is extremely hardy; the timber is of a red colour.

The Rimu and the Remo seem to have confused names—they are Pines allied to each other. The Rimu, termed the Red Pine (*Dacrydium cupressinum*), is a most beautiful tree. When young, its branches bend gracefully down like a Weeping Willow. It grows at some elevation, and attains a height of eighty or ninety feet. The timber, mixed white and red, is of excellent quality.

The Kakikatea, the White Pine (*Dacrydium excelsum*) grows with the red. It is an important timber tree, but not so hardy as the Rimu. It is one of the loftiest timber trees in the country, not unfrequently 120 feet in height, and twelve to fifteen feet in circumference. It grows more in the gorges of the valleys, and has a beautiful appearance when covered with its crimson fleshy drupes. The Matti or Matai (*Dacrydium mai*) is extensively distributed in the islands; grows near Wellington, and much exposed; it attains a height of eighty or ninety feet, and a circumference of ten to twelve feet. The wood is of most excellent quality, of a red colour, and much resembling cedar.

Miro (*Podocarpus ferruginea*) also grows at a great elevation, but is not a tree of any magnitude.

The Kauri (*Dammara australis*), the Rimu, and the Kakikatea attain the greatest growth. The Kauri, however, is a more delicate Pine than the others.

The Ratta (*Metrosideros robusta*), belonging to the Myrtaceæ, is a parasite on other trees. It assumes a strong growth; its wood is extremely hard and durable, and is used for knees for ships. Its profusion of bright scarlet flowers renders it a striking and beautiful object in the forest.

The Aki Aki is another hard and valuable wood, which may be a species of Metrosideros, but likely to be more nearly allied to the Puriri, one of the Verbenaceæ.

The Karaka tree (*Corynocarpus lævigata*) is a very beautiful tree, having large dark, laurel-like leaves. Its berries—about the size of an acorn—are used by the natives steeped, until decomposition takes place, and, when in a very offensive state, the Maories greedily eat them. It grows in exposed places near the coast, and on the sides of the hills. The Karaka stands the frost well.

Rewa Rewa (*Knightea excelsa*), one of the Proteaceæ, yields a very beautiful wood, and is a very ornamental tree, having dark crimson or purple flowers. It is lofty and elegant, growing in the forests, and on the declivities of hills—straight in the growth—attaining a height of sixty to seventy feet, and the timber of excellent quality.

Tetoki of the natives belongs to the Sapindaceæ (the *Aledryon excelsum*). It grows near Wellington. The wood is hard and durable, and the seeds of the tree produce a fine oil.

Koi, or New Zealand yellow flowering Acacia (*Acacia falcata*), grows abundantly on the hills; the wood is hard, and used for canoes.

There are several other specimens of timber trees and shrubs that I shall bring forward on another occasion; but most of those that I have enumerated are sufficient to show that the vegetation where they exist is subject, during the winter months, to much variableness of climate, and at seasons, on the elevations that they grow, to some severity of frost and snow.

There are two plants that thrive luxuriantly in New Zealand, and would equally so in this country—the New Zealand flax and the tobacco plant. No climate is better suited to their growth than Ireland. In the south-west of this country, the *Phormium tenax* has already proved by its splendid growth how well adapted the climate is to its development; and the soil and climate seem well suited to the growth of the tobacco plant. In New Zealand, tobacco of most excellent quality has been cultivated, even where the climate is most humid. Some years since, much exertions were used to introduce to our waste bogs on the western coast the Tussock Grass (*Dactylis cæspitosa*), but not with success. It has, however, been raised from seed in the Orkney Islands; no plant could be established with more certainty than the *Phormium tenax*. In New Zealand it grows rapidly in the cleared ground, and equally well on the hills, in the driest localities, in swamps, and on the sea side, exposed to storm, and to the spray of salt water. The Maori name is Alla Gigi, and when planted in a moist situation in rich alluvial or boggy soil, the fibre is beautiful, fine, and of considerable strength. The flowers contain a sweet liquid, of which bees are very fond. Bees have been introduced to New Zealand from New South Wales.

I cannot omit mentioning that, among the living Ferns that I obtained from New Zealand, I found the pretty little *Sibthorpia europæa* growing attached to the roots of Leptopteris, and to another plant, *Linaria cymbalaria*, which I have successfully grown.

In conclusion, I now refer with some interest to a communication made to me by the late Right Hon. John Wynne, in which were comments on the severe frost that occurred in Ireland in the month of February, 1855, and of its effects on the plants in the neighbourhood of Sligo:—

"The severity of the frost was so great, that Lough Gill, a lake of considerable size, was frozen across, so as to bear skating for about one-third of its length"—a circumstance that occurred once only during the lifetime of his father, Owen Wynne, Esq., who lived to be eighty-five. "The thermometer at Markree Observatory, only six miles distant, and equally near the sea, on 12th February stood at 18·2 Fahrenheit; on the 13th, 17·6; on the 17th, 17·2; on the 18th, 15. There was no snow at Sligo during the continuance of the frost, so that the plants were exposed to its full severity. After the thaw, the sea shore was covered with dead sea fowl."

Mr. Wynne gave a list of the trees and plants under the heads—that were killed—much injured—slightly injured, and uninjured. Among those uninjured were the Pines. Several that were considered of delicate growth—*Pinus canariensis*, several species of Abies, Bermudian Juniper, and other introductions from more temperate climes, were not the least injured. Singular to say that *Trichomanes brevisetum*, growing on the rockery in the open air, and *Aponegeton distachyon*—the latter a bulbous aquatic, a native of the Cape of Good Hope, growing in the reservoir, in the garden—were quite uninjured. This paper, giving all details, was read at the meeting of the Natural History Society of Dublin on the 15th of June, 1855.

Memorandum in reference to tracing of portion of the Province of Wellington. Furnished for the information of General Cameron.

Town of Wellington is on moderately level and undulating land, but surrounded by hills which attain an elevation of from 500 to 700 feet, at only a short distance from the town—say from 100 to 1000 yards. Those on the eastern and southern sides are open, grass, &c.; the western hills being bush in patches, more or less broken by cultivations.

From the northern end of the town, the two principal roads through the province branch off: one, the great north-eastern, leads along the shore of Port Nicholson Harbour, a distance of six miles and a half to Petoni, at the western corner of the Hutt Valley, the hills on the road side being very steep, and covered with bush and undergrowth.

At two miles and a half on this road is a branch leading into the Great North-Western line, ascending through a narrow gulley, hemmed in on both sides with bushy hills, till its junction with the main road at the small village of Johnsonville, four and a half miles from Wellington.

Continuing the north-eastern road from Petoni, the Lower Valley of the Hutt is entered (in shape like an isosceles triangle, about three miles wide at its base, and free from bush): the road to the Hutt bridge and stockade, eight and a half miles from Wellington, is on the western side of the Valley; from thence it continues nearly in the centre, to the first gorge (being the apex of the triangle), at which place the hills and river abut on either side of the road, and the valley, now merely the shingle bed of the river, is not more than a quarter of a mile wide.

The whole of this line from Petoni is through a country once bush, but now fields and cultivations, with detached dwellings on every twenty or thirty acres (on an average).

The first and second gorge occupy about two miles of road, when the valley again expands to a width of from one to two miles: partially cleared and occupied by detached settlers.

At the Upper Hutt stockade, eighteen miles from Wellington, there are a considerable number of houses, owing to the proximity of three saw mills; but the clearing in which the stockade and these houses are built is of comparatively small extent—say from 100 to 200 acres.

From thence to the Mungarva, which is a small stream, falling into the Hutt, and well bridged, the road passes through the same description of country—bush with occasional clearings.

At this point the first ascent takes place from leaving Wellington, the road crossing a range of hills called Mungarl, partially cleared, the bush having been burnt off. A slight descent ends at the Pakuratahi, a small valley occupied by only two or three settlers, whose houses are on the road side.

The Pakuratahi river crosses the road, unbridged, but insignificant in size, and always fordable except in very severe weather: the fresh subsides in a few hours.

The ascent of the Rimutaka now commences, the distance to the summit (2000 feet high) being about five miles, and the descent of, to the township of Featherston, situate in the Wairarapa Valley and forty-one miles from Wellington.

The road over the hill is from twelve to fifteen feet wide, with bush on both sides, but which in many places is burnt for miles, leaving only bare stumps and branches.

The whole distance of forty-one miles from Wellington is a good metalled cart road, and can easily be travelled by a horseman in seven or eight hours.

At Featherston diverge various unformed roads to different parts of the Wairarapa Valley, the principal one being a continuation of the north-eastern line, leading to the small-farm settlements of Greytown, Cartertown, and Masterton.

From Featherston to Greytown, a distance of eight miles, the road is over a level, stony plain, the only impediment to constant traffic being the Tanherenikan, a somewhat broad but shallow stream, liable to freshets in rainy weather, which quickly rise, and quickly subside.

About a mile from Greytown is the Waiohine river, well bridged; thence passing through the Three-mile Bush (metalled), in the centre of which are a few straggling houses on the Carterton township; the road emerges on to the Taratahi plain, through which, on the north-eastern side, runs the Waingawa river, broad and much broken into different channels; but generally fordable.

Masterton township is the last on this line of road, and from thence branches off to the eastward, a track available for horse and foot, to Castle Point, on the east coast, ninety-eight miles by this route from Wellington, and 117 miles by the coast.

At Masterton also commences the track through what is known as the Forty-mile Bush, and leading to Ahuriri.

There are many detached settlers in the vicinity of all the town-ships in Wairarapa, but the southern portion of the valley is occupied by comparatively few persons, all of whom are possessed of large flocks and herds, and with substantial and much-improved homesteads. For character of country, *vide* tracing.

Returning to the other trunk line of road—the Great Western. This, I have already stated, diverges from the North Eastern at Ngahauranga, and passes through a sort of undulating valley—occupied by settlers in all directions—for a distance of twelve miles; then commences the Porirua harbour, along the shores of which the road is carried till it reaches Panhatahanni, twenty miles from Wellington. From this point a native track exists across the hills to about the centre of the Lower Hut Valley, a distance of six or seven miles; but it being only an unimproved native bush track, and for many years but little used, it is somewhat rough.

It was by this path that a body of Hutt militia, volunteers, and friendly natives, crossed to Panhatahanni in July, 1846, with the intention of surprising Rangihaeta, then occupying a small pah at that place. One prisoner was taken—the rebels decamped, retreating up the Horokiwi Valley, and the site of their stockade occupied by our troops for some two or three years—in fact, until the completion of the Porirua and Horokiwi roads, ending on the sea-coast at Paikakariki (see tracing).

The Horokiwi Valley is narrow, and all bush; in some parts occupied by settlers. The road from Wellington—a metalled one—in good order, and terminates on the sandy shore of Cook's Straits, thirty miles from Wellington.

From thence the sand continues in an unbroken line to Wanganni (125 miles from Wellington), the crossings at the rivers being as follows:—

Manawatu Ferry, Rangitikei do.,
Turakina Bridge, Wangaehu do.

XXIII.—*On Black Wax.* By Walter G. Smith, M. B., Assistant Physician to the Adelaide Hospital, Dublin.

[Read May 4, 1868.]

When we meet with a number of products that are derived from the animal and vegetable kingdoms, and which exhibit certain characters indicating analogous properties, it becomes a matter of interest to investigate the nature of the constituents which enter into their composition.

The subject of animal secretions is one of singular interest, especially when we compare varieties in the constitution of analogous secretions from different animals and under varying conditions of climate (Brodie). My remarks on this occasion will be confined to the illustration of a specimen of Black Wax which I subjected to analysis.

In May, 1867, my father, Dr. Aquilla Smith, while in London, purchased from Messrs. Hearon and Co. a portion of a cake of Black Wax, of which no information could be obtained as to its source, except that it was imported from Madras in the year 1862.

The specimen, which is in the Museum of Materia Medica, Trinity College, Dublin, is evidently a portion of a large cake which was solidified after fusion. Its dimensions are six inches by four, and its weight a little more than 18½ ounces; its thickness varies from 1½ inch to 1¼ inch; one side is bevelled, and it retains the impression of the straight side of the vessel, or more probably earthen mould, in which it was solidified. It consists of two distinct layers—the upper, one inch in thickness, of a jet black colour, and its recent fractured surface somewhat conchoidal; the lower layer, which is only to be distinguished from the upper by its browner colour and more granular fracture, is about half an inch in thickness. The cut surfaces of both layers exhibit a waxy lustre, and the upper layer is more readily indented by the nail than the lower.

It does not possess any characteristic odour or taste, and when chewed does not adhere to the teeth.

The upper surface is smooth, and free from impurities; at one side it presents a vesicular appearance, such as usually occurs near the margin of a vessel in which a waxy composition has solidified; the under surface presents some irregular shallow depressions, which are lined with adherent vegetable fibre, apparently the debris of an endogenous plant.

The specific gravity of the thick upper layer is 0·985, a somewhat higher density than that of bee's wax, which averages 0·96; the specific gravity of the thinner brown layer is 1·462. The greater density of this stratum is chiefly owing to the presence of a considerable amount of sand. The fusing point of the black portion is about 148° F., or nearly the same as that of ordinary wax. Very little can be said as to its natural history; but its close resemblance in physical properties to common wax, and Pomet's account of it, which I shall presently quote, would warrant us in concluding that it owes its origin to a particular species of bee.

No mention is made of a similar substance in any of the numerous modern works which I have consulted, including Hagen's "Bibliotheca Entomologica," for reference to which I am indebted to Dr. Perceval Wright.

In one of the earlier volumes of the "Pharmaceutical Journal" (vol. xii., 1853, p. 401, quoted from the Reports of Juries), there is an allusion to a curious wax which has been imported from Brazil, the product of a black bee, which lives underground. It was soft and exceedingly tenacious, and of a dark mahogany colour.

In Pomet's "Histoire des Drogues," published in 1735, there is a short article on the black wax of India which directly bears upon the present subject :—

"De la Cire noire des Indes.

"En plusieurs endroits des Indes, taut Orientalis qu' Occidentales, il s'y trouve de petites Abeilles qui font leurs ruches dans le creux de certains arbres. Ces Abeilles font leur miel dans de petits vaisseaux de cire noire, qui sont de la grosseure et figure des œufs de Pigeons ; ce miel est très agréable et d'une couleur d'Ambre. Les Indiens se servent de cette cire pour faire des cierges, et pour recueillir de l'arbre le baume surnommé de *Tolu*, ainsi que je l'ai marqué ci-devant.

"Quelques auteurs disent, qu'il y a un animal qui est semblable a un chat qui est noir, que les Indiens appellent *Heirat*, ou *Bête à miel ;* qui le plus souvent monte dessus ces arbres et mange tout le miel ; et ce qui est plus surprenant, c'est que cet animal tire les rayons du miel avec sa patte, et ne fait aucun mal aux mouches, et les mouches ne lui en font point non plus, parce qu'elles n'ont point d'éguillon comme les nôtres. Cette cire étoit autrefois fort un usage en Espagne et quelque peu en France, mais à present on ne sçait plus ce que c'est, étant une des plus rares drogues que nous ayons." (In fol., p. 56, II. Partie.)—(Pomet's "Hist. Gen. des Drogues." Nouv. Edit. 1735. Liv. III., p. 168).

I shall now give the details of the chemical examination which I made, with the assistance of Dr. Emerson Reynolds :—

3·009 grammes were exhausted with boiling rectified spirit, filtered and washed.

The dark brown residue left undissolved by the alcohol was treated with ether, and filtered.

On spontaneous evaporation of the ether, a brown colouring-matter remained. This colouring matter was easily soluble in bisulphide of carbon, in benzol, and in chloroform, and, when heated with hydrate of potash, turned black, and evolved ammonia.

It fused very readily, and did not appear to be acted upon by a strong alcoholic solution of caustic potash.

The black substance, insoluble in the ether, was digested with chloroform, which immediately formed with it an opaque, treacly fluid.

Nothing appreciable was taken up from it by benzol, but it was quickly and entirely soluble in bisulphate of carbon, and likewise evolved ammonia when heated with caustic alkali.

The first alcoholic filtrate was concentrated to a small bulk, and let cool, to allow the cerotic acid to deposit. The precipitated acid was then filtered off.

The cold alcoholic solution was evaporated to dryness, and the residual cerolein weighed. The cerotic acid was got by difference.

The results of the analysis are as follows:—

BLACK WAX.			BEE'S WAX.	
	Grms.	Per Cent.		Average.
Colouring matter, insoluble in ether,	0·5142	17·088	Myricin,	73
Ditto, ditto, soluble in ether,	0·1280	4·253		
Cerolein,	0 4530	15·054	Cerolein,	5
Crude cerotic acid,	1·9138	63·602	Cerotic Acid,	22
	3·009	99·997		100·00

The identity of the cerolein with that obtained from bee's wax is shown by its being acid to litmus, fusible at a very low temperature, soluble in ether, and quickly saponified by a hot alcoholic solution of potash.

The quantity of cerotic acid obtained was too small, even had it been carefully purified, to admit of the determination of its atomic weight from the silver salt; but the derivation of it from a wax, its solubility in boiling alcohol, and the character of the precipitates which it gave with alcoholic solutions of acetate of lead and of nitrate of silver all point to its identity with the cerotic acid of Brodie. This cerotic acid appears to exist in the wax in an uncombined state, a fact to which Sir B. Brodie drew attention as being without a parallel among any of the true fats.

It may be remarked that the separation of the cerotic acid from the other constituents is a particularly tedious process, and involves considerable delay.

I have placed the average per-centage composition of bee's wax beside my own analysis for the purpose of comparison.

It will be seen that the per-centage amounts of cerolein and of cerotic acid are each about three times as great as in bee's wax; but it should be borne in mind that the proportion of cerotic acid varies in different samples of wax, and that it was entirely wanting in a specimen of Ceylon wax, and in a wax made by wild bees in Surrey (Brodie).

The place of the myricin, i. e. the portion insoluble in alcohol, and which constitutes nearly three-fourths of the weight of common wax, is represented in the black wax by the two brown colouring matters. It is to be regretted that from the limited quantity of the wax operated on, I was unable to extract a sufficient amount of either colouring matter for the purpose of submitting it to ultimate analysis. A combustion of the wax as a whole would also be desirable, were it only to confirm the statement, that in nearly all the varieties of wax, as well as in the products derived from this body, the carbon and hydrogen are in equal atomic proportions. I shall be glad if any member of the Society can throw any further light on the probable source of this curious wax, which seems to be quite unknown at the present date.

XXIV.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

THE LORDS COMMISSIONERS OF THE ADMIRALTY.

Airy (George Biddell, Esq., ... Astronomer Royal). Astronomical Observations made at . . . . Greenwich, in the year 1865: . . . . 4to. *London*, 1867

THE AUTHOR.

Alanus (Henr.). Hannibal; sive Disputatio, qua id agitur, ut Summus ille Poenorum Imperator contra criminationes quasdam T. Livii Defensus detur. Nunc tertium edita auctior. 12mo. *Dublinii, Londonii, item Edinæ*, 1868

THE AUTHOR.

Alanus (Henr.). Emendationes Livianæ alteræ. Accedunt in Emendationes priores curæ secundæ. 12mo. *Dublinii, Londinii*, item *Edinæ*, 1867

THE AUTHOR.

Belding, Keith, and Co., American Bankers, United States Bonds and Securities. What they are . . . . 8vo. *London*, 1867

THE AUTHOR.

Blake (John A., M. P., ...). The History and Position of the Sea Fisheries of Ireland, ... [For Private Circulation]. 8vo. *Waterford*, 1868

THE AUTHOR.

. . *Case of Ireland stated*, irrespective of Party Considerations. By *Mentor*. 8vo. *Dublin*, 1867

THE TRUSTEES, by J. O. HALLIWELL, Esq.

Catalogue of the Books . . . and Relics illustrative of . . . . Shakespeare and of . : . Stratford-upon-Avon; . . . in the *Shakespeare Library and Museum* in Henley-street. 8vo. *London*, 1868

THE AUTHOR.

Cooke (The Rev. Thomas Fothergill, M. A.). Authorship of the Practical Electric Telegraph of Great Britain; or, The Brunel Award vindicated. 8vo. *Bath*, 1868

THE REV. THOMAS FOTHERGILL COOKE, M. A.

Cooke (William Fothergill, Esq.). The Electric Telegraph: Was it invented by Professor *Wheatstone?* Fourth Edition. 8vo. *London*, 1866

Cooke (William Fothergill, Esq.). The Electric Telegraph: Was it invented by Professor *Wheatstone?* 8vo.

Part I. Pamphlets of 1854-6. *London*, 1857

Part II. Arbitration Papers and Drawings. *London*, 1856

The Author.

Cotton (Henry, D. C. L., Archdeacon of Cashel). Memoir of a French New Testament in which the Mass and Purgatory are found . . . with Bishop *Kidder's* "Reflections" on the same. Second Edition . . . . 8vo. *London*, 1863

The Author.

Crowe (J. O'Beirne of maᵹ coꞃeꝺ chunᵹaı.). Daim Liace (Duleek): its Origin and Meaning. . . 8vo. *Dublin*, 1867

Rev. Beaver H. Blacker, M. A., Booterstown.

Dagley (Richard, ...). Gems principally from the Antique, . . . with Illustrations in Verse by the Rev. George *Croly*, A. M., ... 8vo. *London*, 1822

The Consul for the United States of America.

Diplomatic Correspondence of 1865 (Appendix to). The Assassination of *Abraham Lincoln*, late President of the United States of America, and the attempted Assassination of William H. *Seward* . . . . and Frederick W. *Seward*, ... 14th of April, 1865. 8vo. *Washington*, 1866

The Rev. W. Hickey, Mulrankin Rectory, Bridgetown (Wexford).

Doyle (Martin). Notes and Gleanings relating to the County of *Wexford*, in its past and present Condition. Parts 1, 2. 8vo. *Dublin*:. . . ., 1868

Hommage de l'Auteur.

Fouqué (M. F.). Rapport sur les Phénomènes chimiques de l'Éruption de l'Etna en 1865. 4to. [*Paris*, 1866]

Fouqué (M.). Premier Rapport sur Une Mission Scientifique a l'Ile de Santorin. 8vo. *s. l., s. a.* [1867]

Fouqué (M.). Rapport sur le tremblements de terre de Céphalonie et de Mételin en 1867. 8vo. *s. l., s. a.*

The Lords Commissioners of the Treasury.

Geological Survey of Ireland. Explanation to accompany various Sheets of the Maps of the Geological Survey of Ireland. 52 Tracts by various authors. 8vo. *Dublin, v. a.*, 1858–1866

The Director-General of the Geological Survey of Great Britain and Ireland.

Geological Survey of Great Britain and Ireland. Irish Horizontal Sections, 1–21 inclusive. Maps 88, 89, 90, 96, 97, 100, 101, 102, 106, 107, 108, 110, 111, 114, 117–134 inclusive, 136–205 inclusive, 112, 115, 116. *London, v. a.*

The Author.

Haast (Julius, Ph. D., F. L. S., F. G. S., &c., Provincial Geologist). Report on the Headwaters of the River Rakaia, ... Folio. *Christchurch*, 1867

The Author.

Hutton (Henry Dix, Barrister-at-Law). The Prussian Land-Tenure Form, and a Farmer-Proprietary for Ireland. . . . Second Edition.
8vo. *Dublin*, 1868

E. Perceval Wright, A. M., M. D., F. L. S.

Huxley (Thomas H., F. R. S. . . .), and E. Perceval *Wright*, A. M., M. D., F. L. S., ... On a Collection of Fossil Vertebrata from the Jarrow Colliery, County of Kilkenny, Ireland. . . .
4to. *Dublin*, 1867

The Right Hon. the Secretary of State for War.

James (Colonel Sir Henry, R. E., Director of the Ordnance Survey). Fac-similes of National Manuscripts. From William the Conqueror to Queen Anne. . . . Parts I., II., III., with Translations and Notes. . . . Folio. *Southampton*, 1865

James (Sir Henry, R. E.). Fac-similes of National Manuscripts. From William the Conqueror to Queen Anne. . . . . Part III. With Translations and Notes. . . . Folio. *Southampton*, 1865

The Lords Commissioners of the Treasury.

James (Colonel Sir Henry, C. E., . . .). Fac-similes of the National Manuscripts of Scotland, ... Part I.
Folio. *Southampton*, 1867

Lieut.-General Sir A. Cotton, Bryansford, Castlewellan.

Journal of the East India Association. July, 1867. No. 1.
8vo. *London*, 1867

The Rev. Beaver H. Blacker, M. A., Booterstown.

Law Scrutiny (the) or, Attornies' Guide,. . . .
12mo. *Dublin*, 1807

Lee (the Rev. Alfred, M. A., LL. D., Rector). Some Account of the Parish Church of St. Colmanell, Ahogill. [1865].
8vo. *London*, *Dublin*, *Belfast*, *s. a.*

The Author.

Little (P. C., F. R. C. S. I., L. M., &c.). Cholera: . . . . its Nature and Pathology . . . . Report of twenty Cases, ... successfully treated. . . . *London*, *Dublin*, *Edinburgh*, 1867

The Rev. Beaver H. Blacker, M. A., Booterstown.

ΛΟΓΓΙΝΟΥ (ΔΙΟΝΥΣΙΟΥ) Περὶ Ὕψους. Curante Georgio *Miller*, Collegii Dubliniensis Socio. 8vo. *Dublinii*, 1797

Dominick M'Causland, Esq., Q. C., LL. D.

Λ'ΟΓΟΙ ΕΝ ΛΙ'ΘΟΙΣ, ..., *σύγγράμμα* ΔΟΜΙΝΙΚΟΥ ΜΑΚΩΣΛΑΝΔΟΥ Q. C., LL. D., ... *κ. τ. λ. π.* Μεταφρασθεν *ὑπὸ* ΔΑΝΙΗΛ ΠΕΤΡΟΥΛΙΑ *ἀρχιεπίσκοπου* Ἀργολίδος.
8vo. *ἐν Ἀθήναις*, 1867

THE AUTHOR.

M'Causland (Dominick, Q. C., LL. D.). Shinar. . . . the Confusion of Language and the Dispersion verified. . . ., a Lecture delivered . . . . June 5, 1867. 8vo. *London,* 1867

THE AUTHOR.

Maclean (H., J. P., ...). Sanitary Reform in Dublin: . . . . . . Read at the Social Science Congress, Belfast, 1867. 8vo. *Dublin,* 1867

ALEXANDER M'NEAL, Esq., 50, Lower Sackville-street.

Meteorological Observations made at Pietermaritzburg during the year 1865. Folio. *s. l., s. a.*

THE EDITOR.

Meterologische Beobachtungen angestellt in Dorpat . . . in Jahre 1867, ... Redigirt und bearbeitet Dr. Arthur von *Oettingen*, Professor der Physik an der Kaiserlichen Universität Dorpat. 8vo. *Dorpat,* 1868

THE AUTHOR.

Molison (A. R.). Against the Theory of Tidal Action on the Axial Motion of the Earth, and showing the true Source of Tidal Energy. 8vo. *s. l., s. a.*

THE CONSUL FOR THE UNITED STATES OF AMERICA.

Papers relating to Foreign Affairs, accompanying the Annual Message to the first Session Thirty-ninth Congress. Parts I., II., III. 8vo. *Washington,* 1866

DR. W. BARKER.

Phillips (J.). A General History of Inland Navigation, Foreign and Domestic: . . . . . A new Edition . . . which completes the History to 1795. 4to. *London,* 1795

THE REV. BEAVER H. BLACKER, M. A., Booterstown.

Pisey (Rev. C. T., M. A., ... Camberwell . . . .). The Ministry of Second Causes.—A Sermon. . . . 8vo. *London,* 1866

Pisey (Rev. C. T., M. A., ... Camberwell . . .). Christ's Great Problem.—A Sermon . . . . 8vo. *London,* 1866

Pisey (Rev. C. T. . . ., Camberwell. . . .). Christ's Promise to his Orphan Disciples.—A Sermon. . . . 8vo. *London,* 1867

Poems written in Ireland in January, 1847. 12mo. *Dublin,* 1847

THE SECRETARY OF THE QUEEN'S UNIVERSITY.

Queen's University Calendar, 1868. 12mo. *Dublin* and *London,* 1868

THE AUTHOR.

Rive (M. le Professeur A. de la). Notice sur Michel Faraday, sa vie et ses travaux . . . . . . 8vo. *Genève,* 1868

THE REV. BEAVER H. BLACKER, M. A., Booterstown.

Search (Warner Christian, LL. D., F. R. S., and M. R. I. A.). Metaphysic Rambles, ... 8vo. *Dublin,* 1835

Sketch of the State of Ireland, Past and Present. . . . Eighth Edition. 8vo. *Dublin,* 1822

DR. W. BARKER.

Stevenson (Robert, Civil Engineer, F. R. S. Edin. . . . .). Reports on different Canals and Railways in Scotland, and on the Improvement of the Bristol Channel. 4to. *Edinburgh, v. a.* [1814–17–18–19–21–22–26]

[*These nine Reports, with separate titles, are bound together in one volume, lettered "Canals and Railways."*]

THE PATHOLOGICAL SOCIETY OF LONDON.

Transactions of the Pathological Society of London. Volume Eighteenth . . . . Session 1866–67. 8vo. *London,* 1867

SCIENCE AND ART DEPARTMENT, LONDON.

Universal Catalogue of Books on Art . . . . A—ABAENA. 4to. *London,* 1868

THE AUTHOR.

Watson (J. Forbes, M. A., M. D., F. L. S., F. R. A. S., &c.). Index to the Native and Scientific Names of Indian and other Eastern Plants and Products. 8vo. *London,* 1868

COUNT BISMARK, *for the School of Art.*

Vorbilder für Fabrikanten und Handwerker. *Berlin,* 1863

THE AUTHOR.

Wright (E. Perceval, M. D., A. M., Professor of Zoology, University of Dublin, ...). Contributions to a Natural History of the Teredidæ. 4to.

[From Transactions Linn. Soc., vol. xxv.].

(Signed) EDW. RICHARDS PUREFOY COLLES,
Librarian.

June 4, 1868.

BOTANIC GARDEN.

DR. HOOKER, *Royal Gardens, Kew* :—23 rare Plants.

DITTO :—One Plant of Victoria Regia and 20 young Palms.

MR. THOMPSON, *Seed Merchant, Ipswich* :—7 kinds of Seeds of rare Plants.

THE GOVERNMENT, *Botanic Garden, Sidney,* by order of the Director, MR. CHARLES MOORE (now in England):—One large Wardian case filled with *Cycadaceous* Plants, new or rare, and of considerable value.

J. T. Cookson, Esq., *Elm Park, Drumcondra*:—124 parcels of Seeds from Australia, Buenos Ayres, &c.

W. B. Hankey, Esq., *Hitcham Park, Leatherhead, Surrey*:—12 kinds of rare varieties of British Ferns.

His Excellency Sir J. Young, Bart., Capt.-General and Governor-in-Chief, *New South Wales*:—3 parcels of rare kinds of Seeds from New South Wales.

Sir Thomas Larcom, Under Secretary for Ireland (sent to him by Sir J. Young):—Parcel of rare Seeds from Australia.

C. Moore, Esq., Director Botanic Garden, *Sydney, N. S. W.*:—Wardian case filled with Plants of new and rare kinds.

Dr. Martins, *Botanic Garden, Montpellier, France*:—Fruits of *Salisburia adiantifolia*, for Botanical Museum (*very rare*).

Ditto:—100 kinds of Seeds.

Mr. Parker, Nurseryman, *Exotic Nursery, Tooting, Surrey*:—9 kinds of very rare Plants.

Messrs. Veitch, *Royal Exotic Nursery, Chelsea*:—32 kinds of the newest and rarest Plants in England. (*Very valuable donation.*)

John Edward Vernon, Esq., D. L., *Mountmerrion*:—A large assortment of new and rare Pelargoniums from open ground.

— Gibson, Esq., Director, &c., *Battersea Park, London*:—A large assortment of Pelargoniums from open ground.

Mr. Lee, Nurseryman, *Hammersmith, London*:—2 very rare Plants.

Dr. Prior, 48, *York-terrace, Regent's-park, London*:—Parcel of Seeds of a rare Plant.

Dr. Carte, J. P., *Royal Hospital*:—12 kinds of Seeds of Plants from Australia.

Rev. A. O. Stark, *Lower Lacyfield Rectory, Newtownstewart*:—Parcel of Seed of the Desert Pea, from Queensland, Australia.

Miss Webb, 2, *Winslow-terrace, Rathgar*:—12 kinds of Seeds of Plants from Australia.

Rev. J. Madden, *Kilmanagh Rectory, Callan*:—2 parcels of Seeds from New Zealand.

The International Exposition of Paris (through Captain Mayne), one of the Commissioners for New South Wales:—A box containing 52 samples of Woods, Fibres of Plants, &c., for Botanical Museum.

Dr. Perceval Wright:—A valuable selection of Specimens from the Seychelle Islands, for the Botanical Museum, including male and female inflorescence of the Double Cocoa Nut (*Lodoicea Sechellarum*), true Bread Fruit (*Artocarpus incisa*), and Jack Fruit (*Artocarpus integrifolia*), &c., &c.

Miss Hamilton, *Greytown, Central America*:—4 kinds of rare Seeds.

Mr. P. A. Shannessy, *Rockhampton, Australia*:—5 kinds of very rare and valuable Seeds.

Dr. Calmiero, *Botanic Garden, Madrid*:—A valuable collection of Spanish Seeds; 383 kinds.

Master of the Rolls in Ireland:—A valuable collection of Lily Bulbs from Japan, and also 85 kinds of Seeds from Japan.

Mr. O'Keeffe, Nurseryman, 10, *Heytesbury-street*:—100 young Oaks for silk-worms.

Dr. Murphy, R. N. (care of R. Roe, Esq., *Royal Naval Hospital Plymouth*):—2 Bulbs of Oxalis and 6 kinds of Seeds from the Cape of Good Hope.

Ditto:—Seeds of Victoria Regia, &c.

Messrs. Veitch, Nurserymen, *Royal Exotic Nursery, King's-road, Chelsea*:—One rare and valuable Plant of *Nepenthes lanata.*

Signeior Todaro, Director Botanic Garden, *Palermo*:—330 kinds of Seeds.

J. Ball, Esq.:—14 kinds of Rice, as cultivated in India, for Botanical Museum.

Henry West, Esq., Q. C., *Loughlinstown*:—Specimens of Wood Fibre, found in a pipe drain, manifesting the dangerous consequences to be apprehended from the employment of pipe drains.

(Signed) D. Moore, *Director.*

June 5, 1867.

L. Waldron, Esq., D. L., Hon. Sec. Royal Dublin Society:—Collections of Butter Vessels illustrative of the appliances used by the French, Dutch, Belgians, Germans, Frieslanders, and the people of the Channel Islands, in sending their Butter to British markets. These specimens were procured by Mr. Waldron with the view of improving the system of making up Irish butter for those markets.

NATURAL HISTORY MUSEUM.

Mr. John Douglas, *Kilkea Castle, Kildare*:—Specimens of Trout from a stream near Kilkea Castle.

Lieut.-Colonel Atkinson, *Dunran, Wicklow*:—A young Woodcock, and a Woodcock's Nest, containing four eggs, found in an oak wood at Dunran, Wicklow.

Captain Henry D. Grant, 4, *St. Thomas's-terrace, Charlton, S. W.*:—Several bottles containing specimens of Fish, Crustacea, and Parasites, taken in the Gulf Stream.

Ditto:—A set of Drawings of Fish and other Marine Animals, captured on board of H. M. S. Steady, in 1863.

Walter Sweetman, Esq., *Castle Anna, New Ross*:—A Pelican, shot near to New Ross, having escaped from the Zoological Gardens, Phœnix Park.

W. Corbet, Esq., *Castle Connell, Limerick*:—A Virginian Horned Owl (*Strix virginiana*).

Ditto:—A Goshawk (*Falco palumbarius*).

Ditto:—A Hybrid Pheasant and a hen Golden Pheasant.

Dr. Fulton, *Roebuck House, Milltown*:—A fine series of the Eggs of Native Birds, comprising 74 Species.

John Good, Esq.:—Specimens of various kinds of Fish.

Hon. Col. Deyrolles, B. De Moleyns, *Burnham, Dingle*:—The Skull of a very rare Cetacean (*Ziphius sowerbiensis*), which had been cast ashore near Dingle (presented through W. Andrews, Esq.).

Henry B. Murray, Esq., *Heywood, Clonmel* (through P. Riall, Esq.):—A fine specimen of the Holby (*Falco subbuteo*), shot at Marlfield, Tipperary, in the spring of 1867; and a Stormy Petrel (*Procellaria Leachii*), found near Clonmel.

Dr. Purcell, R.N., 71, *Harcourt-street*:—Two specimens of the Spiculæ of a Sponge (*Hyalonema setacea*), from Enosima, Japan.

George Walker, Esq., Secretary, *Exhibition Palace*:—A Love Bird and a Great Horned Owl, from the Aviary at the Exhibition Palace.

Lord Talbot de Malahide, *Malahide Castle*:—A stuffed specimen of the Little Tern (*Sterna minuta*), shot at Malahide.

G. H. Porter, Esq., M. D., 21, *Kildare-street*:—A collection of Irish Birds, comprising 62 specimens.

Major J. D. Swinburne, 92nd Highlanders (per Miss Walshe, 16, *Royal Terrace, Kingstown*:—A rare Parrot from Singapore.

W. R. Atkin, Esq., 5, *Merrion-square*:—2 specimens of the Common Tern (*Sterna hirundo*).

Leonard Dobbin, Esq., 27, *Gardiner's-place*:—A fine specimen of flexible Sandstone from Delhi.

Captain T. W. Hutton, *New Zealand*:—Specimens of Shells collected on the Voyage to Australia and in New Zealand.

Professor Oldham, *Director, Geological Survey of India*:—A fine collection of the Skins of Indian Birds.

Captain John Dunn, *Geelong, Australia*:—The Skeleton of a Shark from Australia, Skin of a Kangaroo, Slough of a Snake, and other specimens of natural history from Australia.

Lord Powerscourt, *Powerscourt House*:—Two Skeletons of the Wapiti Deer (*Cervus canadensis*), male and female.

C. B. Ball, Esq., 43, *Wellington-place, South*:—Egg of the Stormy Petrel (*Procellaria pelagica*).

Earl of Enniskillen, *Florencecourt, Enniskillen*:—A fine specimen of a fossil Nautilus (*Nautilus imperialis*, Sow.), from the London clay.

NORMAN MOORE, Esq., *St. Catherine's College, Cambridge*:—A small collection of Fossils from the Lower Greensand formation of Upware and Potton, Bedfordshire.

HASTINGS TWISS, Esq., M. D., *Ballinrobe, Co. Mayo*:—A specimen of the Long-eared Owl (*Otus vulgaris*).

A. A. DUNLOP, Esq., M. R. D. S., *Devonshire Terrace, Howth*:—A few Insects from India and Penang.

BOARD OF TRINITY COLLEGE, DUBLIN (per the Rev. Professor HAUGHTON, M. D.:—A Cast of the Meteoric Stone which fell at Dundrum, Co. Tipperary, August 12, 1865.

J. R. STEWART, Esq., D. L., 6, *Leeson-street*:—Ten Birds' Skins from Ceylon.

JOHN H. BLAND, Esq., *White Abbey, Belfast*:—A small collection of fragments of Roman Pottery and Tesselated Pavement, &c., from Pompeii.

HON. JOHN TUTHILL BAGOT, Corresponding Member Royal Dublin Society, Memb. Legislative Council, *South Australia*:—Specimens of Gold-bearing Quartz from Lyndock Valley, South Australia.

COLONEL ATKINSON, *Dunran, Wicklow*:—Two Skulls of Tigers; 1 Skull of Bear; 1 Skull of Elephant; Ears, Foot, and Tusks of Elephant, from Ceylon; 2 pairs of the Antlers of the Ceylon Elk (*Ruso Aristelis*); 2 Shells (*Pinna nigra*); 2 Daggers, 2 Fans, and a Club, from India and another from Ceylon.

F. W. BRADY, Esq., D. L., 22, *Lower Leeson-street*:—A Female of the Rose Parrakeet (*Palæornis rosa*), a native of India.

T. F. CALLAGHAN, Esq., *Stephen's-green Club*:—A small collection of Beetles and other Insects from Borneo.

HON. CAPTAIN DORMER, A. D. C., *Dublin Castle*:—A small collection of Land and Fresh-water Shells from India.

DITTO:—A pair of Horns of the Brow-antlered Deer (*Panolia Eldii*) from Burmah, and the Head and Horns of the Neilgherry Ibex (*Kemas Warryato*), both shot in India.

ROBERT H. SCOTT, Esq., *Meteorological Survey, London*:—Some Bones of the Cave Bear (*Ursus spelæus*) from Prussia.

MONTAGUE H. ORMSBY, Esq, *Hastings-street, Calcutta*:—A fine specimen of Apophyllite with Stilbite.

MISS S. HAMILTON, *Nicaragua* (per Rev. Professor HAUGHTON):—A few Snakes, some Shells, and other specimens from Nicaragua.

WILLIAM ANDREWS, Esq., *Ashton, Monkstown*:—A Parrot (*Platycercus Novæ-Zelandiæ*).

WALTER H. JONES, Esq., 18, *Harcourt-street, Dublin*:—A very fine collection of Lichens, principally Irish, together with a large number of Microscopic slides illustrating the structure of the different species; also various collections of Fungi, Mosses, Seaweeds, &c., and a number of Books and Catalogues, and a series of Fossils from different formations, chiefly collected in the British Islands by the late Admiral Jones.

CHARLES J. SHORE, Esq., *Waterfall House, Richmond*:—A fine specimen of the Little Grebe (*Podiceps minor*) in the adult plumage.

VALENTINE BALL, Esq., *Geological Survey of India*:—A number of Birds' Skins, four Human Skulls, a Monkey, a Flying Squirrel, some Land and Fresh-water Shells, and a number of Insects collected in India.

COMMODORE SIR F. L. M'CLINTOCK, R. N.:—Specimens of Fish, Crustacea, Echinodermata, collected in Jamaica.

DITTO:—A box containing Fish from Jamaica.

DITTO:—Two Eggs of Alligator from Jamaica.

GEORGE WALKER, Esq., *Dublin Exhibition Palace*:—An Indian Grosbeak (*Hesperiphonia*).

ROBERT A. WARREN, Esq., *Moyview, Ballina*:—A Red-throated Diver (*Colymbus septentrionalis*) in transition between winter and summer plumage.

MRS. KIRBY:—A Queen Ant (*Termes*) and a Scorpion from India.

W. KANE, Esq., *Drumreaske House, Monaghan*:—Two Eggs of the Woodcock, taken near Aughnacloy.

M. T. HEDDLE, Esq., M. D., Professor of Chemistry, *St. Andrew's University*:—A collection of Minerals, 66 in number, chiefly from the Shetland and Faröe Isles.

MAJOR DEVENISH MEARES, 20th Regt.:—A Stormy Petrel, a Sponge, and the siliceous spiculæ of a Sponge from Japan.

ALEXANDER MACALISTER, Esq., M. D., 13, *Adelaide-road*:—Some larva cases of different species of *Oiketicus*.

PHINEAS H. RIALL, Esq., *Old Connaught, Bray*:—Two Golden Orioles (*Oriolus Kundoo*) from India.

ALEXANDER CARTE, M. D., F. L. S., *Director*.

June 4, 1868.

INTELLIGENCE.

BOTANICAL AND HORTICULTURAL NOTES,

Made on a Journey through Parts of the South of France, Spain, and Portugal, during the Autumn of 1867. By D. Moore, Ph. D., Director of the Royal Dublin Society's Botanic Garden, Glasnevin.

FROM DUBLIN TO PARIS.

Leaving Dublin on the evening of the 16th September, I reached Paris in time to attend the meetings of the Botanical Congress, which was held there last autumn. I visited some of the public places in company with the members, and, among others, that large and remarkable plant establishment belonging to the city, called the Jardin Fleuriste de la Ville de Paris. It differs from anything of the kind we have in Britain, in its magnitude, its management, as well as in the purposes the plants are used for. Large quantities of them are bedded out during the summer months in the Bois de Bouloigne and public parks in and about Paris. In winter and spring they are nursed, cared for, and propagated in this great nursery garden.

A great number of rare and valuable plants, such as palms, dracœnas, tree ferns, agaves, &c., are grown for the purpose of decorations, when grand balls are given by the Emperor, chiefs of Government, and municipality of Paris. It is supported out of the revenues of the city, and the quantities of camellias and other plants grown there and sent out annually is almost incredible. A visit to it enables us at once to comprehend how the French are able to make such marvellous changes on their parks and pleasure-grounds in a few days such as they frequently do.

When walking through the conservatories and grounds I made lists of some plants, for the purpose of trying to effect exchanges, which I hope to be able to do soon.

At the old Jardin des Plantes there is yet a fine collection of herbaceous plants, well cared for, and in good condition with respect to arrangements. In the way of bedding out plants to produce a subtropical effect, I considered the finest examples I saw in France or elsewhere was at the pretty Park Monceaux, which is quite a gem in its way, though not nearly so much frequented by visitors to Paris as the other better-known parks and pleasure-grounds are. Originally it was a nearly flat piece of ground, but lately it has been altered and undulated with artificial mounds. Along with masses of Cannas, Caladiums, Cyperus, &c., we noticed one bed which contained twenty-four plants of the beautiful tree fern, *Lomaria cycadifolia*, with stems varying from two to four feet high. Near it a bed of *Sida tricolor*, with a brilliant border of *Portulaca Thellusoni* looked very gay. Beds filled with *Ficus Cooperi*, and *Portulaca* for a surrounding border, looked well also. The fine large-leaved plants, *Wigandia Vigieri*, *Solanum Warcewiczi*, *Ferdinandia eminens*, &c., were very effective, and also a bed filled with *Begonia ricinifolia*. The hardier kinds of Palms and Musa ensette were scattered in quantities through the grounds, which added much to the subtropical appearance of the gardening at Park Monceaux. I might extend my observations on the flower gardening near Paris, but so much has been written during the past year on this subject, by the well-known correspondent of the "Field," "Gardeners' Chronicle," &c. "W. R.," I shall not notice it further here, but pass on southwards.

PARIS TO BORDEAUX AND BAYONNE.

On leaving Paris we went direct to Bordeaux, *via* Tours and Poitiers. We had met M. Durieu, the Superintendent of the Bordeaux Botanic Garden, at the Congress in Paris, who had not returned from the great city when we visited the garden. It is small, but well arranged botanically, according to the system of De Candolle. It is, however, surrounded by a more extensive public park, of which the garden forms part. Here military bands perform in the evenings, particularly on Sundays, when the promenade is much frequented by the inhabitants of the town. The portion which is botanically arranged is fenced off with hedges and palings. The conservatories are of modern construction, and contain a considerable collection of plants. One very large plant of *Vanilla aromatica* occupied nearly the whole roof of one house, with its stem of more than one hundred feet in length, trained in a zig-zag manner, where room for it could be found. It produces abundance of fruit annually. Many of the plants and trees growing in the open air indicated a southern climate. *Magnolia grandiflora* attains a height of 40 feet as a standard, and flowers profusely. Several other species of *Magnolia* grow proportionately large there. *Chimonanthus fragrans*, *Chionanthus virginica*, and *Photinia serrulata*, make pretty small trees. At the time of our visit, *Acacia Julibrissin* was in full flower, on trees from 25 to 30 feet high. The Chusan palm (*Chamærops Fortuni*) was flowering, and we observed several handsome plants of it. We were interested at seeing a good collection of well named grasses, among which we observed some handsome and ornamental kinds, not seen in the open air in English botanical gardens. In the aquarium, *Nelumbium speciosum* was flowering freely, without protection or artificial heat, and along with it in the same pond several species of *Nymphæa*, which require the heat of a plant stove with us. Also several species of *Sagittaria* which we were not previously acquainted with, viz., *S. obtusa*, *S. latifolia*, and *S. lancifolia*. I made lists of some grasses and other plants which were desiderata at Glasnevin, with a view of endeavouring to effect an exchange of plants. From Bordeaux we went by rail to Bayonne. The line leads through a flat, sandy, heathy country, bordering on the sea nearly all the distance. It is on this portion of Gascony, called the Landes, where the French have been so successful in raising magnificent and extensive forests among wastes of blowing sands. These we passed through for many miles, and observed the trees to consist chiefly of *Pinus maritima*. The quantity of rosin and turpentine produced from those forests annually is of great value, as those who visited the International Exposition, and paid attention to the products of forests there exhibited, might soon have learned. The peasantry were then busy at this work. A deep cut is made round, or nearly round the whole of the tree, dividing the lower from the upper portion of the bark, about four feet from the ground, at which place an earthenware vessel was fixed, so as to intercept the downward flow of resin. The persons who attend on the process go round the trees at intervals, and empty the vessels according as they become filled with the resinous fluid. The trees are not often killed by this operation, as we saw many of them that had been operated on during previous years healthy and thriving. Large tracts, covered principally with the Mediterranean heath, *Erica mediterranea*, occurred near Marcherprima and at other places. The cork oak, *Ilex suberosa*, and Mulberries, were the kinds of trees planted near the houses in this district, and the crops in the fields consisted chiefly of maize and millets, with melons and gourds.

When at Bayonne, we went to see Biarritz, the favourite summer residence of the Emperor. It is only from five to six miles (English) distant from the former place, and well appointed stage coaches pass to and from it every hour or oftener during the day. The road passes through a beautiful and fertile country, with lines of trees on each side, which afford grateful shade from the heat of the sun to pedestrians particularly. We observed the Carolina poplar, *Populus angulata*, to be a favourite tree in this district of France, some fine examples of which grow near Bayonne. Near the sea, where the cutting winds from the Bay of Biscay have much influence on vegetation, *Tamarix gallica* is commonly planted, and grows to a large size. In gardens and parterres near dwelling-houses *Bignonia grandiflora* is common, and was flowering very profusely at the time of our visit. The South American pampas grass is also a plant generally cultivated here, where it attains a much greater size than it does in England. It was gratifying to see this plant, which we had introduced to Europe, and distributed from the Glasnevin Botanical Garden, now become so great a favourite with the people in the south of France and also through the Peninsula. The pretty *Erica vagans* is very abundant on the cliffs near the sea at Biarritz, which, along with our *Statice occidentalis* and *Santolina chamaecyparissus*, are the prevailing plants there.

BAYONNE TO IRUN AND MADRID.

From Bayonne we went by rail to Irun, the frontier town in Spain, where the French railway terminates and the Spanish begins. A very marked change with the voyager takes place here, his French being of little more use to him as a language for communication. The alteration from French to Spanish is made passing from one side of the railway station to the other. The uniforms of the police, or gendarmes, and appearance of the men themselves, are also very marked. We were now on our way to Madrid. The part of this line next the French frontier is very beautiful, skirting along the Bay of Biscay, of which several fine views are obtained passing, until St. Sebastian is reached. The crops cultivated in the fields and gardens were similar to those we had seen in France, consisting of maize, millet, melons, gourds, &c. The ascent from the bas Pyrenees is very gradual, and the country becomes roughly undulated as a higher level is attained, resembling a good deal some parts we have seen in Wales. The hills appeared to rise to a height of from 500 to 2000 feet or upwards, and are covered more or less to their summits with shrubs and trees. Oaks and sweet chestnuts were the prevailing kinds we could recognize from the railway carriage as we passed along. Orchards of fruit trees were also of frequent occurrence. After passing Vittoria, the line ascends to a high table-land on by Burgos, Valladolid, and Avilla.

The traveller who enters Spain by this route gets a very unfavourable impression of the country, at any period of the year, but more especially during the summer months, when vegetation is completely dried up, and little else left to his view, save here and there a few pines and oaks, growing among masses of savage-looking rocks. The cattle of different kinds, including sheep and horses, may be seen wandering about in bare-looking dusty fields, where there is nothing green, and yet they look in tolerable good condition. Their principal support at that period of the year appeared to be shrubby plants, growing among the rocks and the underground stems of *Cynodon dactylon*, a grass which is invaluable in Spain. The stems run extensively under ground, similar to those of our Scutch grass, *Triticum repens*, producing tufts of leaves as they extend. No amount of heat or drought seems to be injurious to its growth, but rather to favour it. It was a frequent species of grass in all the districts of Spain we visited, growing luxuriantly on dry, barren, sandy ground, where no other species was to be seen at the time. I may here observe that this grass is of great value in Australia also for cattle feed, and is one of the principal kinds used about Sydney for forming the grass lawns to gardens.

About Avilla, and for many miles on each side of it, there is very little arable land to be seen from the line of railway, the face of the country being in most places strewed over with large boulders and masses of rock, with several species of Cistus, Cytisus, &c., growing among them. The little villages and farm houses were as miserable and wretched-looking as the country about them is; they are mostly long, lumbering, square-like edifices, built for the most part with rough stones, without any apparent plan, though each bears a marked resemblance to the other outwardly. In many places we found them to be surrounded by dry stone walls, but scarcely saw an instance of trees being cultivated about them, to give shade from the burning heat of the sun; this rough, barren country continues until the famous Escurial is reached, when it gets more arable and better cultivated on to Madrid. We observed *Pistacea lentiscus* growing wild in this part of Spain, where it forms a rather handsome small tree.

After being a night at Madrid, we went next day to see the Botanic Garden. It is close to the city, near the famous Museo, or picture gallery, and was founded by Ferdinand VI., in 1755. The entrance gate is grand and imposing, and must have been built originally at great expense. If the interior were equal to the exterior, the Botanic Garden at Madrid would be among the finest in Europe; but that is not the case. The botanical portion is nearly of square form, divided into four parts by walks, crossing at right angles. The herbaceous plants are arranged in natural orders; but the collection is small, and cultivated with a good deal of difficulty, owing to the heat and drought of the climate. The trees are more interesting, and contain among them some fine specimens of kinds which in most English gardens scarcely survive our winters, and at best are small, compared to the sizes they attain in the south of France, Spain, and Portugal. Here *Celtis occidentalis* grows 70 feet high; *Sterculia platanifolia* grows to a large tree; *Fontanesia philyræoides* 20 feet, or more; *Gymnocladus canadensis* and *Aïlanthus glandulosa* are common trees about Madrid, where they grow very large. In the garden a fine plant of *Acacia farnesiana* was 40 feet high, in full flower; *Amyris polygama* about same height, with many others proportionately large, which we seldom see higher than ordinary shrubs in England. Statues of Cavanilles and La Gasca are placed at the termini of the principal walks.

Attached is a good Herbarium, which contains fine collections of Mexican and South American plants, as well as large collections from other parts of the world. They are arranged in natural orders on the shelves, and the few we had time to examine are in excellent condition. The Library, which adjoins the herbarium, is rich in botanical literature, but the lecture-room near it is small, and not suited for a large audience. We were well received here, and exchanges of seeds, &c., offered.

Although the neighbourhood of Madrid is by no means favourable for the growth of trees, being very hot and dusty in summer, and cold and damp during winter, they yet grow very well when properly managed. One of the finest arboricultural sights we saw in Spain is the trees along both sides of the Prado, or grand promenade, which extends nearly two English miles, and is planted on both sides with rows of magnificent trees. They consist chiefly of Robinias, Gleditchias, and Sophoras, all of which attain large sizes. At the time we visited, in September, the Gleditchias were in full fruit, bearing legumes nearly a foot long. We can form only a sorry idea of the grandeur of this genus, judging from the specimens we see in England. The beautiful pinnated foliage of those plants had a fine effect when seen by gas light, with thousands of the fashionable inhabitants of the city promenading and sitting on seats underneath them, which they do every evening during the summer months.

Our English elm is a favourite tree with the Spaniards, and grows pretty well in some parts, though few others of our park trees are to be seen in the southern and interior parts of Spain. In some of the open squares and places through the city, such as the Plazo Congresso, we observed the Chinese privet, *Ligustrum lucidum*, and several kinds of New Holland Eucalypti, all doing very well; but there is not much taste displayed in their arrangement. *Nerium oleander* is the standard ornamental shrub everywhere through Spain, which, with *Poinciana Gilliesii* and *Erythrina crista galli*, make a grand show. We visited the Museum of Natural History, which is not rich, the collection of minerals excepted; but there are many magnificent specimens among them. The Picture Gallery is very extensive, and many fine pictures in the collection.

MADRID TO BADAJOZ AND LISBON.

On leaving Madrid we proceeded by rail to Alcazar, thence by Ciudad Real and Badajos to Portugal. The journey to Ciudad Real was performed during night, which prevented us from seeing the features of the country as we passed along. That large town stands in the midst of extensive sandy plains, with bare-looking fields, over which clouds of dust were blowing when we saw it. The seeds of Compositæ, of several kinds, but especially of thistles, were filling the air like flakes of snow in some places. After passing Ciudad Real the country was more fertile, and increased in beauty as we proceeded onwards.

We were now among the olive groves and extensive vineyards, with pomegranates, figs, and fields of melons and gourds; at every little station fine fresh grapes, peaches, and melons were on sale, at very low prices. The weights used in some instances were of a primitive nature, consisting of stones of different sizes. The Spaniards seemed to prefer the water-melons to the other fruit, or rather water itself, which is sold at every station, where the cry of "aqua, aqua, aqua pura" is heard. The line passes through a very picturesque country, winding among mountains, which appeared from our carriages to be from 1000 to 2000 feet or more high. By the sides of rivulets running down their sides, and between the hills, we first saw the beautiful *Nerium oleander* growing wild, which was in full flower. *Arbutus unedo*, *Erica mediterranea*, *Daphne gnidium*, with several pretty kinds of Cistus, were all very abundant plants in this part of Spain.

Where cereal crops are cultivated, the preparing of the ground is done in a very slovenly way, the surface being little more than merely scratched over with a small kind of plough, which we saw the man who held it lift from the ground with one of his hands, when he turned round at the end of the field; yet we were told that very good crops of wheat are grown here among the extensive olive groves. The trees are generally planted in parallel rows, and thus afford a slight shade to such crops as are cultivated among them.

At Badajos we were desirous to see the battle-field of the memorable siege of that place, where the ashes of so many of our countrymen lie; but finding that a train direct to Lisbon would soon leave, we preferred going on, and had very little time to see the neighbourhood of Badajos.

After passing the next stage is Elvas, the frontier town of Portugal, where our luggage was examined and passports vised. The houses of the Portuguese appeared to be better built and more comfortable than those we had seen in the country parts of Spain; the country is also more fertile and better wooded. We passed through extensive forests of Cork Oak (*Quercus suber*), where the people were busy stripping off and preparing the bark, which we saw lying in great quantities at the railway stations, ready to be conveyed to the place of shipment, which is generally Lisbon. Numerous herds of swine were feeding on the acorns among the trees. In low, moist places we observed excellent crops of maize, which is extensively cultivated there. It was with much regret we passed over a portion of this country by night, and consequently were deprived of seeing it until we reached Lisbon.

One of our great objects in visiting the Peninsula was to inquire into a malady which has occurred within the last few years among the orange trees, not only in Europe, but also in Australia. Near Sydney there were some of the finest and most productive orange orchards in the world until lately, when this disease attacked them, and nearly destroyed the whole of them. Scarcely an old tree is now left alive out of many thousands. After my brother had completed his business at the Paris Exhibition, he was directed by the Australian Government to proceed to Spain and Portugal for the purpose of inquiring whether any similar disease was known in those old orange-producing countries; and, if so, to endeavour to learn something about the way it was treated by cultivators. Our first field of inquiry was in the neighbourhood of Setubal, a small town on the opposite side of the Tagus from Lisbon, where oranges are extensively cultivated. There we soon discovered among the trees a disease resembling in many instances that which has proved so fatal to the orange trees in Australia. Though it has only been known a few years in Portugal, it is increasing, and some of the orchards have already suffered severely from it. We learned from M. de Canto, who cultivates oranges extensively on his estates at St. Michael, one of the Azores, that it is well known there, and has killed many of the old orange trees. This disease, so far as we saw or could learn about it, commences near the base of the stem, at the surface of the ground, where a small putrid spot appears, and soon afterwards spreads, extending downwards among the roots, which become affected, and die first on the side of the tree where the putrescence is. The branches near the top of the tree now show signs of disease, by losing their leaves and dropping their immature fruit. The leaves and stems of the tree become more liable to the attack of brown scale and Aphis than they are when in a perfectly healthy state, and both those insects are frequently found preying on them. If the putrescence extends round the stem, the tree dies off soon after. To prevent that from taking place, we found the managers of some of the orchards provided with a sharp, hooked iron instrument for cutting out the diseased parts as soon as possible after they make their appearance; and were told, if the operation be performed successfully, and in time, the plant recovers, and after a year or two becomes quite healthy again.

We got the workmen to dig up some of the diseased roots of trees which were partially affected; and found them soft and putrid, having a disagreeable stench. We could not find that the roots which remained healthy on those partially diseased trees were attacked by the mycellium of any fungus, nor could we find any fungoid substance on the diseased roots until they had become rotten. No cure appears to be known for it by any of the people we conversed with. The full-grown trees in those orchards varied from 10 to 20 feet in height, and in age from 5 to 80 years or so. They are generally of a handsome round-headed form, with drooping branches, having a spread nearly equal to that of the height of the tree. About those orchards the fences in many instances were made by large plants of *Agave americana* and *Opuntia*, *Ficus indica*, &c.; they also formed fences against the encroachment of cattle on the railway embankments, the steep faces of which were in some places covered with Mesembryanthemums, which flower to perfection there. The fruit of the Opuntia is gathered as they ripen, and sold in the markets, as apples and pears are sold with us.

The Date tree, *Phœnix dactylifera*, grows to a large size in the gardens near Setubal, and bears fruit. We also observed a number of New Holland and Cape of Good Hope plants growing luxuriantly there, among which we noted *Araucaria excelsa*, *Grevillea robusta*, *Acacia stricta*, *Acacia falcata*, *Achania malvaviscus*, *Abutilon striatum*, *Bignonia grandiflora*, *Lagerstræmia indica*, *Poinciana Gilliesii*, *Entelia arborescens*, and *Tecoma Australis*, with many of the old kinds of Cape Geranaceæ, and several species of Ipomeas and Convolvulus; the two latter were flowering abundantly among the branches of trees they were climbing on. The Vine, Olive, Pomegranate, Fig, and Walnut are all cultivated together in the neighbourhood of Setubal, which is surrounded by a charming country, though a very dirty and slovenly town itself. In waste heathy places we observed a dwarf species of Quercus growing close to the earth, which, with *Helianthemum algarvense*, covered large spaces of ground.

We next visited Cintra, which is the Brighton of Lisbon, and certainly one of the most charming spots I have seen in Europe. The first six or eight miles of the road from Lisbon leading to it pass through a beautiful country, where many of the wealthy merchants of the city and some of the nobility also reside. The villa gardens on both sides of the road are continuous, and we had the pleasure to be among a profusion of roses, Bignonias, Ipomeas, &c., a considerable portion of the way, which would have been very enjoyable only for the clouds of dust which were blowing about. To the lovers of rare plants and fine scenery the neighbourhood of Cintra affords no ordinary treat. The Palace Gardens of the King and Queen of Portugal are extensive, and in laying them down advantage has been taken of the natural beauty of the bold headland on which the Royal Palace is built, at an elevation said to be fully 3000 feet above the sea, which washes the base of this rocky promontory. The view over the Atlantic on one side, and inland through Portugal on the other, is very grand, and terminates only with the range of vision. The ascent from the town to the Palace is generally made on donkeys or mules, which, though easy and sometimes amusing to strangers, is a very commonplace way of passing through such scenery. At every turn of the road winding up the hill a new view is opened out, which the muleteer hurries you past, in order that he may have his cattle all together.

Oaks and chestnuts appeared to be the prevailing natural wood, but many other foreign trees and shrubs have been planted among them. The bare rocky spots produced abundance of dwarf furze, which seemed the same as our Irish furze, *Ulex nanus*. In some parts of the Royal Gardens we saw magnificent examples of the Australian Araucarias, plants of which we can only form a very faint idea of their beauty, from seeing them starved in tubs, or drawn up, unable to support themselves, in close conservatories. At Cintra they are from 40 to 50 feet high in some instances, and as strong and healthy as we see spruce firs in England. *Araucaria excelsa*, *A. Cunninghami*, *Dacrydium cupressina*, *Thuja Doniana*, *Dammara australis*, are all fine specimens there. Also *Cryptomeria japonica*, *Podocarpus japonica*, *Podocarpus spinulosa*, *Podocarpus elongata*, *Fuchsia arborea*, *Myrtus melastomoides*, *Lophospermum australe*, *Myoporum scabrum*, *Pittosporum tobira*, and *Pittosporum undulatum*, are plants we took notice of as being remarkably fine. *Erica arborea* grows all over the face of the hill, and low down, where it is sheltered by the wood, it rises to a height of 10 to 15 feet. *Erica ciliaris* was also growing in considerable quantity on some parts near the top of Cintra head, surrounded with masses of Cistus and Helianthemums. *Erica australis* appeared to have been planted in the places we saw it growing. On the north side, where there was more of shade and shelter, the moss-covered trees in the natural woods and also the rocks are in many places covered with the rhizomes and fronds of the beautiful hare's-foot fern, *Davallia canariensis*, which is a charming species as it grows in its natural habitats. What I have thus stated is a mere epitome of that which might be written on those beautiful gardens, and only such as our hasty visit enabled us to note as we passed through them.

From Cintra we went on to Montserrat, which fortunately has fallen into the hands of Mr. Cook, of London. Although this gentleman only resides a few months during the early part of the year there, he is sparing no expense to render Montserrat what it is capable of being made—one of the most interesting spots in Europe. Some idea of it may be formed by imagining a space of ground a thousand times larger than that under the roof of the great Winter Conservatory lately erected at Kew, devoted to foreign plants, scattered and in groups. In a moist shady dell we observed a group of tree ferns, which, though only planted a few years, are growing very well, and appear likely to succeed. *Alsophila excelsa*, *Alsophila australis*, *Cyathea dealbata*, *Dicksonia antarctica*, and *Cibotium Baromets* are all doing well, and growing as freely there as they do in their native countries. The Australian Conifers are also very fine.

During our hasty visit we noted the following plants:—*Eucalyptus corymbosa*, from 60 to 70 feet high; *Eucalyptus globulus*, nearly same height; *Podocarpus nereifolius*, *Podocarpus totara*, *Fitzroya patagonica*, *Lomatia heterophylla*, *Banksia latifolia*, *B. spinulosa*, and *B. integrifolia*, *Hibiscus Pattersoni* (a beautiful tree, from 25 to 30 feet high); *Cantua dependens*, *Luculia gratissima*, *Flindersia australis*, *Knightia excelsa*, *Ficus elastica*, *Calliandra virgata* (a beautiful species), *Rhopala Jonghi*, *Stadmania australis*, several kinds of Metrosideros and Theophrastas, *Parkinsonia aculeata*, *Bignonia stans*, *Alpinia nutans*, *Cyperus papyrus*, *Cordylines*, and *Dracænas* a good many kinds.

Some of the more hardy Palms are also planted out, and succeeding, among which we noticed *Areca sapida*, *Chamærops Martiana*, *Chamærops Fortuni*, *Seaforthia elegans*, *Latania borbonica*, and *Phœnix dactylifera*. On a parapet wall, near the door of the dwelling-house, *Tacsonia ignea*, *Tacsonia mollissima*, and *Thunbergia grandiflora* were hanging in beautiful festoons, full of flower. In charge of so many costly plants, Mr. Cook is fortunate to have an excellent gardener, Mr. Burt, an Englishman, who appears to understand their management admirably.

Returning from Montserrat, we saw growing in a small garden, near the road side, the plant, which is supposed to be the best in Europe, of *Araucaria excelsa*. It is 70 feet high, and a perfect picture for symmetry of form, from base to apex.

We had not yet visited the old Botanic Garden at Lisbon, which contains a few remarkable plants, particularly the large Dragon Tree (*Dracæna draco*), which now, since the old plant of it at Oratava is destroyed, is probably the next largest known. It is planted in the open air, and at four feet from the ground the stem is said to be 21 feet in diameter. A little higher up it branches into thirteen large limbs, forming a circle, which are again branched into similar limbs, and smaller than the first tier. The diameter of the spread of the branches and their leaves is 33 feet. We could not ascertain the age of this extraordinary plant, which must have withstood the rigours of many winters where it now is. There are some fine Date Palms growing near it, varying from 30 to 50 feet high.

In one portion of the garden the plants are arranged according to the system of Linneus, and in another part we were gratified to see a printed board, indicating that the plants there are in "Ordines Naturales, Systematis Lindley." At the present era it is interesting to see this old garden, which affords probably as good an example as is to be found of what botanical gardens were during the sixteenth and part of the seventeenth centuries. The Conservatories, of which there are several, are also of very old-fashioned structure, and were nearly empty at the time of our visit. The best plants are those in the open ground, among which we noticed a fine *Araucaria excelsa*, also *Ficus elastica*, *Lagerstræmia indica*, *Pittosporum Tobira*, and *P. undulata*, some 20 feet high, and laden with ripe fruit. In the open squares and public places, where trees are planted near Lisbon, a favourite species is *Schinus molle*, called by the local name of Pepper Tree, which I have not mentioned before. This plant, which is only known by name in botanical gardens in England, is one of the most charming we have yet seen, as it grows in Portugal, where it attains a height of 15 to 20 feet, and is of handsome form, with slender drooping branches, which were loaded with a profusion of scarlet berry-like fruit, about the size of a red currant. It is planted everywhere about Lisbon, but the finest plants we saw are growing in the garden which is so much frequented by the inhabitants during the summer evenings. The male is not nearly so handsome as the female plant, as we had an opportunity of judging in this public promenade, where a good many of both sexes have been planted.

Fuchsia corymbiflora, *Fuchsia arborea*, *Joekroma Warcewicksi*, *Habrothamnus elegans*, *Hibiscus tillæfolius*, *Poinicana Gilliesii*, *Bignonia stans*, *Bignonia grandiflora*, &c., are all very common plants in the Lisbon parterres.

On the bank of the Tagus, near Belem Castle, we noticed some large plants of Dracænas, Cordylines, and Date Palms, in the gardens there.

The vegetable market at Lisbon is worth visiting during the fruit season, where tons of melons may be seen lying on the ground in heaps, with gourds and vegetable marrows of all sizes, shapes, and colours. A favourite variety of the latter was of a long form, varying in some from a foot to nearly a yard in length. The vendors cut it in slices, and sold it by weight to the poor people, who did not purchase a whole fruit. Excellent grapes were selling at 3*d.* (English) per lb. Peaches looked well outwardly, and were nominally cheap, but of very bad quality. They are mostly grown on trees raised from seeds without being grafted with good sorts. All cling stones, dry, and hard to eat. Though the climate there be so favourable for the production of peaches, nectarines, &c., very little care seems to be taken by cultivators to improve them. They are left to nature, as many more of the fruits and vegetables of that country are. The floral portion of the market was very poor and scanty of plants. Fuchsias, Heliotropiums, Asters, and a few old-fashioned Pelargoniums, were the principal stock in the trade. Among the vegetables were large quantities of garlic, several kinds of capsicums—one, a large scarlet-fruited variety we had not previously seen, was lying in heaps on the stalls. A longish variety of turnip, with a purple top, was the kind on sale when we visited.

LISBON TO CADIZ.

Having now completed the inquiries we wished to make relative to the disease of the Orange, in so far as it is known in Portugal, we took our berths in a steamer bound from Lisbon to Cadiz, glad to escape for a time from the oppressive heat and dust of the former place. This proved the pleasantest part of our journey, though we were caught on our arrival at Cadiz, and had to remain three days in quarantine there. We got on shore about five o'clock in the afternoon, when our luggage was taken to the Custom-house to be examined. The officers had left for the day, and a deputation from the passengers waited on the principal one in charge; but they failed to persuade him to come from his house, which was close by, to pass our luggage. Our portmanteaus and bags were put inside of an iron gate, which was locked, and we had nothing for it but to go and look for lodgings, without our luggage, which we happily procured on explaining how we were circumstanced. It was nearly twelve o'clock, A. M., on the following day before it was examined and given to us. I relate this trifling incident to show that travellers in Spain may still expect to meet some unpleasant things as they pass along, though these difficulties have been magnified greatly by sensational writers on the Peninsula. We were well received and well treated everywhere we went, and found the Spaniards a fine intelligent race of people. In the evening we walked out on the Alameda, which forms a charming public promenade on the rampart surrounding the city, where the cool sea breeze is enjoyed by the people, who frequent it in large numbers after the great heat of the day, which is much felt at Cadiz.

Everything here had a more Eastern appearance than the other parts of Spain we had visited. The inhabitants are mostly very dark-complexioned, and evidently have a considerable mixture of Moorish blood among them. Their houses are all flat-roofed, on which many families were amusing themselves in the cool of the evening. Numbers of fine Date Palms are planted on the Alameda, and along with them we observed a large species of Phytolaca, which attained a height of 30 feet or so. It did not look well or healthy; the leaves were attacked by aphides, and much discoloured in consequence. Our English Elm did duty here also, but looked rather a stranger, and far from home in this situation. The Pepper Tree, *Schinus molle*, is planted about Cadiz, but does not grow nearly so well there as it does at Lisbon. *Nicotiana glauca* attains the size of a small tree, and seems a favourite plant. Different kinds of Musas are cultivated in gardens, and also in the enclosed court-yards, which are so common there. The pretty *Melia zederach* makes a fine tree, and is frequently planted for the shade it affords. In the markets and also at the corners of the streets heaps of melons were lying, some of which were very large, and slices of them were sold at a very cheap rate to those who did not want a whole fruit. Grapes were also very good, and cheap, and the fruit of the prickly pear seemed a favourite with the Cadiz people, who were buying it and eating it at the stalls as we passed along. The vendors have always water, which the people invariably drink of after they eat the fruit of the prickly pear. We were told it was very dangerous to drink wine after eating this fruit. The earth nut, *Arachis hypogæa*, is also sold in large quantities in the markets through the southern parts of Spain. Small handsome baskets, made from the stems of the *Arundo donax*, similar to those which are so common in Covent-garden market, are used at Cadiz for holding fruit of different kinds, but not, so far as we could observe, as measures of it.

CADIZ TO SEVILLE.

It was our intention to go through the Strait of Gibraltar, and get along the orange producing parts of Spain which border the Mediterranean, but finding we would again have to undergo quarantine at Gibraltar, if we went that way, we gave up the route, and proceeded from Cadiz to Seville, which is so famed for its oranges. On our way thither we passed through one of the greatest wine-producing countries in Spain—namely, the neighbourhood of Jeres de la Frontera, well known from the sherry wines manufactured there. It is on the opposite side of the bay from Cadiz, and is situate in a dry, warm locality. Here nothing is seen but vineyards for several miles, with *Agave americana* and Opuntias forming fences to them. The dwarf-fan palm, *Chamærops humilis*, grows spontaneously in quantities by the side of the line of railway and over all the sandy waste places we could see, continuing nearly the whole way on to Seville. Although in such profusion, we did not see any plants among the masses with stems higher than from one to two feet or so. This made us suppose we only saw a dwarf variety of the species here, judging from the heights we have seen stems grow to in our conservatories; but we were told by the people at the Botanic Gardens of Seville and Valencia that it is the true normal state of the plant which grows so abundantly over the south-eastern parts of Spain.

It was dark before we reached Seville, and on getting up next morning we were pleased to see bouquets of the beautiful flowers of *Phaseolus caracalla* standing in different parts of the hotel. On looking out on the court-yard we saw it was covered over with this plant, the stems of which were crossed over and recrossed on wires put up for the purpose. It was profusely in bloom, and the delicate perfume of the flowers was sensibly felt outside the building. We visited some extensive orange orchards in the neighbourhood of Seville, for the purpose of inquiring whether the disease I have already mentioned had yet attacked any of the trees there, but we were unable to find any trace of it in this district. We, however, met a gentleman at the hotel where we lodged who knew about it, and told us it was proving very destructive to the orchards about Valencia.

The bitter variety of orange is that which is chiefly cultivated near Seville, but there are orchards of sweet oranges also. The trees are planted in rows about twenty feet apart, and, when old, fill up the spaces between each other with their branches as they spread. Orange trees are planted round the squares, and along the sides of public walks, at Seville, with seats placed under them for the people to rest on. Fountains are generally in the centre of these open spaces, which cool and damp the warm atmosphere, rendering those evening retreats very enjoyable.

The finest sub-tropical garden we saw in Spain is that belonging to the Duc de Montpensier, near Los Delicias. It is not scientifically arranged, like a botanical garden, though it is called one, and deserves the name better than many others which enjoy that title. Some of the finest date palms in Spain are here; one growing near the palace is full 60 feet high, a female plant, which was fruiting abundantly when we saw it. Others of both sexes, and also of large sizes, are scattered through the grounds. Some other palms grow freely in the open ground here, among which we noticed fine specimens of *Cocos flexuosa*, *Latania borbonica*, and *Raphis flabelliformis*. Groups of Musas are planted through the garden, and fine examples of *Musa ensette* in single plants; also groups of Bamboos and Sugar canes, which produced a fine effect. Among the rarer plants we noticed *Parkinsonia aculeata* 30 feet high, and seeding freely. *Sterculia platanifolia* and *Phytolaca sapota* are also fine. It was here we first saw the Erythrinas in their full vigour and beauty, some of which had stems upwards of three feet in circumference, and were covered with brilliant scarlet flowers. *Lagerstræmia indica* was also covered with its gorgeous flowers, on plants from 12 to 15 feet high. The New Holland trees seemed quite at home in this garden. Araucarias, Grevilleas, and Acacias are growing as freely there as they do in the most favoured parts of their native country. We also observed some very fine specimens of succulent plants planted out in the open ground, such as *Cereus multangularis*, 20 feet high, and stout in proportion; *Cereus monstrosus*, 6 feet high, branched into twenty principal stems. Near the latter stood a remarkable plant of *Yucca filamentosa*, with a stem about 14 feet high, which has sent out ten other stems at that height, each of which is almost 7 feet long. The walks lead through shady groves of orange trees, myrtles, &c., to the conservatories, where pine apples and other fruits are cultivated.

From the Duc de Montpensier's garden we went to the gardens of the Alcazar, which are rather pretty, but did not contain any remarkable plants which we had not already seen.

The fruit market at Seville is profusely supplied with all the kinds we noticed elsewhere, which here seemed superior in quality. The flower market was also better, and baskets full of small bouquets were on the stalls, consisting of a single flower of tuberose, one of *Jasminum sambac*, another of *Jasminum grandiflorum*, and a yellow Banksian rose, with a pelargonium leaf under them. They are sold at about ½*d.* (English), and were quickly bought up.

SEVILLE TO VALENCIA.

Our next journey was a long and wearisome one—from Seville to Valencia, *via* Cordova, Alcazar, and Albacete. The Oleander and dwarf-fan Palm occurred at intervals during the first part of the road to Cordova, where, on reaching, we saw some good orange orchards, with olives, figs, and pomegranates in great abundance. The surrounding country about Cordova is exceedingly beautiful, being rather mountainous and much undulated; besides, it is better wooded than most parts of Spain, and the arable land better cultivated.

From Alcazar to Almansa the country had a very dry, barren appearance in many parts; but after passing the latter it improved gradually all the way to Valencia. On this route the line of railway passes through one of the most extensive, beautiful, and highly cultivated valleys in Spain, where all the fruits the country is famed for yielding are extensively cultivated. After passing Montesa we saw evident symptoms of the malady among the orange trees, which increased as we went onwards. At Jativa and near Carcagente many of the trees were either dead or dying, and, as we afterwards learned, had caused serious alarm among the cultivators in that district. In these orchards the symptoms of disease were in every way similar to those we had seen in Portugal, and only known to the people about the same space of time. Though the trees are of great age, they were never known before to be attacked in a similar way. Date Palms are very common in this valley, and very productive. The first rice fields we had yet seen in Spain were of considerable extent here, and in several places we saw large threshing floors made, on which the grain was being trod out by the feet of horses, in a similar way to that we know to have been in common practice for treading out corn a thousand years and more ago.

At Valencia our progress was intercepted for several days in consequence of a change which took place in the weather. For upwards of seven consecutive months there had scarcely been any rain there, and the temperature had been higher than is usually the case in the month of September, when, suddenly, one of those terrific thunder storms so well known along the shores of the Mediterranean, occurred, accompanied by torrents of rain, which continued uearly three whole days and nights. This had the effect of flooding the country, and stopping the traffic on some of the lines of railway, particularly that from Valencia to Barcelona, where the embankments gave way, and covered the rails to a considerable extent. As soon as the weather admitted of our visiting the Botanic Garden, we went to see it, and sent our cards to the Superintendent, who refused to admit us on that day, in consequence of the walks being so soft after the late rains. The gate porter who brought us the message stated, that if the following day was dry, the walks would be harder, and we might then be admitted if we called. Finding ourselves obliged to yield to circumstances, we spent the remainder of the day elsewhere, and called again next morning, when we were admitted. Here we found the best collection of plants we saw in Spain. The Superintendent and his son joined us, and were very attentive in pointing out the best and rarest plants under their care. The ground is flat, and divided into squares by walks crossing at angles, and the plants here are arranged according to the system of Endlicher. There is a considerable range of conservatories for protecting the plants during winter, which were nearly empty when we saw them, and the stove kinds all standing outside; even the Breadfruit, *Artocarpus incisa*, which is so tender, was growing freely among them. One of the best collections of Cacti in Europe is in this garden, and some fine specimens of Mammillarias and Melocacti among them. Attached to the back wall of one of the conservatories was a magnificent plant of *Bougainvillea peruviana* in full bloom. This so-called species appeared to be nearly the same as our *B. spectabilis*, with larger flowers. By the aid of the Superintendent we took the dimensions of some of the trees in the collections, amoug which are *Araucaria excelsa*, 65 feet high; *Olea fragrans*, 20 feet; *Pinus canariensis*, 50 feet; *Callitris quadrivalvis*, 50 feet; *Diospyros lotus*, 40 feet; *Polymnia grandis*, a beautiful plant, with large pinnatifid leaves; *Catalpa Bengi*, 40 feet, a fine species, not known, that we are aware of, in British gardens; *Cratægus obvionia*, a large plaut; *Yucca filamentosu*, with a stem six feet in girth; *Nelumbium speciosum* was flowering in a small poud without any artificial heat, and a fine Convolvulaceous plant, new to us, called there *Argyreia choisyana*, was flowering on the end of one of the houses.

We got a catalogue of the plants cultivated here, and an offer to exchange any of them in duplicate for plants from our collectious.

The Queen's Garden (Jardin de la Reina) is another of the public gardens at Valencia, where we saw some good plants. Aloug with Date Palms and Musas, *Persia gratissima*, *Alpinia nutans*, and *Clereodendron fragrans*, were all growing freely in the open air; also *Cestrum parqui*, *Leonitis leonuris*, *Duranta Plumieri*, *Callistemon rigidum*, Myrtles, Lagerstræmias, Erythrinas, and *Poinciana Gilliesii*, were very common plants. In another open square, the Plaza Gloriana, were some good Magnolias, Metrosideros, tomentosa, *Bignonia capensis*, *Habrothamnus elegans*, &c.

Oue of the principal trees planted here is *Ailanthus glandulosus*, which grows to a large size; *Populus angulata* is also a favourite, and some good plants may be seen by the sides of the road leading from Valencia to the Grao, or harbour, on the Mediterranean.

VALENCIA TO TARRAGONA AND BARCELONA.

We had intended to proceed to Tarragona and Barcelona by the railway, which skirts the Mediterranean nearly all the way to the former of these towns; but hearing that there were some parts we could not pass over, owing to the late rains, we took berths in a coast steamer from Valencia to Tarragona. The weather was fine, and the vessel sailed near to the Spanish coast all the way, which enabled us to get a fine view of the country and some of the principal ranges of mountains on the Mediterranean side of the Peninsula.

At Tarragona we had only time to look around that ancient town, and collect a few seeds of the native plants growing on and about the fortifications, when we took rail for Barcelona. The line runs close to the sea shore a considerable part of the way, and the embankments were fenced against the encroachment of cattle by the *Agave americana*, some plants of which were very large, and many of them in flower. After leaving the coast we passed through a continuous series of vineyards nearly all the way to Barcelona. We could not hear of any gardens possessing much botanical interest near this thriving and beautifully situated town.

The fruit market which we visited was similar to those we had elsewhere seen in Spain—melons, grapes, garlic, onions, and capsicums being in abundance. We saw for the first time the fruit of *Pyrus domestica* on sale here, and bought some for the seeds it contained. In the market gardens we observed large squares of capsicums cultivated in the open ground, and also squares of the purple Auberges, *Aubergine violette*.

On the fortification hill we had a little botanizing, and saw here the Spanish broom, *Spartium junceum*, in large quantities, *Lavendula spicata*, *Daphne gnidium*, *Genista spinosa*, *Echinops ritro*, and the little orchid *Neottia autumnalis*, were among the plants collected. The grand promenade, called the Rambla, which occupies the centre of Barcelona, is planted on each side with rows of *Platanus orientalis*, the spreading boughs of which nearly meet across from side to side, and form a leafy canopy, under which are rows of seats, and thousands of people promenading during the evenings.

BARCELONA TO MONTPELLIER.

We were now making our way back to France by Gerona, to which town a line of railway from Barcelona leads through a pretty and fertile country, where we observed that crops of buckwheat, *Polygonum fagopyrum*, were not uncommon in the fields, along with maize and millets. The first attempts at cultivating crops of field turnips, carrots, and cabbages, we had seen in the country were in this district; but some of them were not very successful. From Gerona we crossed the Pyrenees by diligence to Perpignon, in France, which enabled us to observe the crops cultivated in the country we passed through, and the wayside plants, better than we could do by railway.

Extensive vineyards occupy the greater part of this district, which are in many instances close to the public road, without any protection. A very common hedge plant in this part of Spain is *Paliurus aculeata*, which, if properly dressed and well cared for, would make a formidable fence; but in the loose, straggling way it is allowed to grow, it makes only a very poor protection against the trespass of cattle, &c. *Coriaria myrtifolia* is also a common plant in hedge-rows there, and *Rosmarinus officinalis* grows on the dry banks. The Stone Pine, *Pinus pinea*, occurs in considerable forests through many parts of Catalonia, especially between Barcelona and Gerona, and is a handsome tree when allowed to take its natural form; but in most instances it looked scraggy, owing to the way the side branches are lopped off, and only a few near the apex of the trees left. Judging from the paucity of plants we saw when crossing the Pyrenees, the Flora there is not nearly so rich as similar passes which we have seen among the Alps are, where the climate is moister and more favourable to vegetation. Here again we observed the Platanus doing duty as a road-side plant, and seemingly as much at home among the mountains as it is near most of the large towns through Spain.

It became dark soon after we got to the French side of the mountains, which prevented us from seeing more of the country until we reached Perpignan. This southern portion of France, and onwards along the coast of the Mediterranean, *viâ* Narbonne and Cette, to Montpellier, is one endless series of vineyards, where hardly anything else is grown. The neat and careful way the vines are cultivated here contrasts in a remarkable manner with the slovenly way they are managed in many parts of Spain. The plants are annually cut back to a few buds above the ground, and the fruit of the succeeding year is borne on the young shoots, which are allowed to spread themselves over the surface without being tied up to stakes. By this method of cultivation, the fruit is nearer to the earth, and receives more heat than it would do if the branches were staked up, which is said to have a considerable effect on the quality of the wine produced from it; but it can only be practised in very dry countries, as heavy rains would dash the mud on the grapes, and deteriorate them.

We made very little delay at any of the intermediate places until we reached Montpellier, when we went to see the ancient and far-famed Botanical Garden there. The Director, Dr. Martins, was, unfortunately for us, absent from home, attending the meeting of the British Association, held in Dundee, and, as we afterwards learned, was at Glasnevin on the same day we were at Montpellier.

This garden was founded so early as 1598, and has had many of the celebrated botanists of the last two centuries connected with it. Great care has been taken to commemorate the names of the different Professors and benefactors to it. For example, one of the great leading walks through the garden is called the Alee De Candolle, another the Alee Cusson, and so on. There are busts of Delile, Rondelet, Pellisier, Nissole, de Sauvages, and Broussenet, in conspicuous parts of the grounds. The collections of herbaceous and medical plants are very good at Montpellier, and well arranged and named.

Many of the trees are very old, and have attained large sizes. One the most interesting among them is a plant of *Salisburia adiantifolia*, which at a short distance bears more general resemblance to a large tree of *Populus alba* than it does to Salisburia, as we see it developed in England. It has a handsome clean bole for more than 20 feet before it branches out into a wide-spreading head; at two feet from the ground it is 10 French metres and 4 inches in circumference; on one side it was covered with handsome yellow pulpy fruit, about which a curious statement was made to us. This species, though generally considered monoecous, is sometimes dioecous, and the Montpellier plant, being a female, branches of a male plant were brought from Kew, and grafted on the former, which had never borne fruit up to the time the grafts were inserted on it; but a few years afterwards fruit was produced, which has been annually the case ever since, and is only abundant on the side where the grafts were placed. We certainly saw where grafting had deen done on several of the large branches.

Good examples of the following plants were observed:—*Maclura aurantiaca* (Osage orange) 40 feet high, and bearing fruit; *Sterculia platanifolia*, 50 feet or so, fruiting; *Styrax officinalis*, 20 feet; *Diospyrus virginiana*, 30 feet; *Populus caroliniana*, 80 feet; *Celtis australis*, 60 feet or more; *Euonymus japonica*, 20 feet; *Phillyrea latifolia*, from 50 to 60 feet; *Quercus bullata*, a large tree.

The collection of Gleditchias have grown to large trees, and some of the species are very remarkable looking plants, particularly *Gleditchia caspica* and *Gleditchia sinensis*, variety *ferax*. The former bears large, broad legumes, from 10 to 14 inches long; and the latter has the whole of the old stem covered over with the singular spines, so common in this genus.

MONTPELLIER TO LYONS AND GENEVA.

After leaving Montpellier we went on to Tarrascon, passing through extensive vineyards and olive grounds nearly all the way, when we got on the Paris and Marseilles line, which leads through the picturesque valley of the Rhone to Lyons. The scenery on some parts of this line is charming, and rivals, as we thought, that on most parts of the Rhine. The sides of the undulating hills, covered with vines and cultivated to their summits, with the pretty villages as they occur at intervals on the banks of the river, give a peculiar appearance of fertility and industry to this district. Walnut, chestnut, and almond trees are frequent there; but we had now left the olive grounds. Here the vines are tied to stakes, as is the general method of cultivating them in most parts of France. It was cheering to observe the clean, comfortable appearance of the people as we passed along, whose neat cottages and well-kept gardens contrasted very favourably with those we saw in most parts of the Peninsula.

It was night before we reached Lyons, and as we were not able to remain long there, we resolved to make the most we could of the time at our disposal. On getting up next morning we went at once to the heights of Faurvieres, which command a magnificent view of Lyons, the windings of the Rhone and Saone, as well as of the surrounding country. After returning we visited some of the public squares and the vegetable and fruit market. The bedding-out plants did not present anything very particular among them, though those who have only seen the different kinds of Cannas, as they grow out of doors in England, would be surprised to see the size they attain in the South of France.

The pretty little *Aster dumosa* seemed to be a favourite plant for forming edgings round the beds, and looked well near scarlet Pelargoniums, &c. The new promenade along the side of the Rhone is one of the finest on the Continent, extending as it does an English mile and a half or more. *Platanus orientalis* is planted on each side of it a portion of the way, and Lombardy poplar, *Populus fastigiata* over another portion.

We had very little time to examine the Public Garden, which is some distance from the city, and appeared to be more for pleasure than for scientific purposes.

Leaving Lyons, we journeyed onwards to Geneva, by Amberieu, Culoz, and Bellgarde. The flat meadows near the Rhone were quite gay with the flowers of *Crocus autumnalis* and *Colchicum autumnalis* in many parts as we passed along, and when we reached the narrow mountain gorge, through which the road leads a considerable portion of the way, our common box tree, *Buxus sempervirens*, was in great abundance over the bases of the hills.

One of our principal objects in visiting Geneva was to see the old and far-famed Botanic Garden there; but we found it was the names of De Candolle and other botanists which have given notoriety to it, more than any peculiar botanical merit it now possesses. The garden is small, and much overgrown with large trees, which are not favourable to it. The collection of herbaceous plants is good, and among them we noticed many scarce species. There is also a small range of conservatories, but the plants in that department are in nowise remarkable. Busts of Rousseau, Bossuet, De Saussure, and Senebier are placed in different parts of the garden. We were rather unfortunate in not meeting the Superintendent, but were enabled to examine the plants very well, and make lists for exchange. The Jardin Anglais, as it is called, is small, but rather pretty, and is situate on the margin of the famous lake, over which it commands a fine view of the surrounding country as far as Mont Blanc. It was our intention to go from Geneva to Zurich, to visit once more our kind friends at the Botanic Garden there; but we learned that cholera was raging fearfully at Zurich, which prevented us from carrying out our plan of visiting that place.

GENEVA TO BRUSSELS.

The time at our disposal for making the journey being now nearly exhausted, we resolved to take the most direct route to Brussels, only staying a short time at Berne and Basle. On this journey we passed on so quickly we had no time to make many notes. On nearing Darmstadt the line of railway passes through a forest of pines, where we observed misletoe in great quantities growing on the branches and stems of *Pinus sylvestris*, a tree we had never before seen it on. Can this be the true *Viscum album?* It was on the 27th of September we passed through Rhenish Prussia, where we saw the tobacco crop much damaged by frost at this early period of the year. The people were at work in the fields pulling the leaves off, and laying them in heaps, in order to save them as far as possible; but we were told they were rendered almost worthless by being thus touched with frost.

We remained some time at Brussels, for the purpose of visiting Mr. Linden's collection of plants at the Jardin Royal de Zoologie et d'Horticulture, where so many novelties in the way of plants have been introduced to Europe. To those who are interested in rare and newly introduced plants, this establishment is fraught with peculiar interest. Mr. Linden gives much attention to plants connected with the sciences and arts, and has been able to get together a great many of them, and also a most extensive collection of the more beautiful and saleable kinds, many of which command high prices in the market.

It would take more space than we are able to devote to the subject in these brief notes to mention all the rare and interesting plants we observed in this garden—a few must, therefore, suffice. Along with *Artocarpus incisa*, Mr. Linden has introduced a fine species from the Phillipine Islands, which he thinks has not yet been named. It has larger leaves than the common breadfruit, but seems to be a species of Artocarpus; also a species of Helliconia, with magnificent foliage, and a curious and rather handsome species of Aristilochia we had not previously seen. *Tillandsia Lindeni*, *Theophrasta glauca*, *Theophrasta crassipes*, *Ficus dealbata*, *Cupania undulata*, *Erythroxylon macrophyllum*, *Paulinia sorbilis*, *Lasiandra macrantha*, *Passiflora macrocalyx*, and *Gustavia brasiliensis* are all fine and very desirable species. The collections of Palms and Orchids here are very extensive, and that of Tree Ferns probably the best in Europe. *Adiantum speciosum* and *Adiantum Muthewsii* are two beautiful species of that handsome genus, and, so far as we know, are newly introduced, as Mr. Linden considers them to be. This gentleman is always willing to do business with caterers for botanical gardens at as reasonable rates as he is able, for money, or in exchange for good plants. We were able, on both terms, to get from him a considerable number of desiderata.

BRUSSELS TO GHENT AND ENGLAND.

After looking through the Botanical Garden at Brussels, we came on to Ghent, and there visited our esteemed and very liberal correspondent, M. Louis Van Houtte. This extensive and varied establishment is so well known to all lovers of either showy or rare plants, and of horticulture in general, it would be superfluous to make any lengthened comment on it here. Among the many beautiful Palms which have been introduced lately, we noticed fine supplies of *Areca speciosa*, *Latania Commersoni*, *Subal princeps*, *Calamus ciliaris*, and *Phænocophorum sechellarum*. A pretty Aralia we had not previously seen, named *Aralia Inkie*, *Dracæna Kneickiana*, and a pretty new Scutellaria, with scarlet flowers, from Costa Rica, are interesting plants. The extensive collection of Hyacinths and other bulbs cultivated by M. Van Houtte were being prepared for transmission to the different countries in Europe at the time of our visit.

The Botanical Garden at Glasnevin has been so often enriched by large and valuable donations from this gentleman, I felt diffident to ask for anything more, particularly as my brother was getting from him a collection to take to Sydney. I however hinted I would like to purchase some plants at his catalogued prices, a list of which was sent after I reached Dublin, and all those required have been transmitted safely to us, payment in money having been declined for them.

The last collection we visited on the Continent was that of M. Verchaffelt, which contains a very valuable and extensive assortment of fine plants. Here we noticed a splendid new Tree Fern, which is named *Cibotium regale*. It bears some considerable resemblance to *Cibotium princeps*, but is more beautiful in every way. The long, shaggy golden-coloured hairs on the rachides and about the bases of the stems form a marked feature in this plant. *Amorphaphalus nervosus*, *Cocos Mikaniana*, *Latania leucophylla*, *Zamia vernicosa*, *Zamia cycadifolia*, *Zamia Verchaffelti*, *Cycas Ruminiana*, *Vriesia glazionana*, *Agave applanata*, *Agave Greisbechti*, and *Agave Verchaffelti* are all remarkable and fine plants, as well as many others we observed at this place.

On reaching London we again visited the Nurseries of Messrs. Veitch, Lee, Henderson, Rollison, and others, and reached Dublin on the 3rd of October, after being absent seven weeks.

ON MUSICAL AND SENSITIVE FLAMES,

Abstract of a Lecture delivered, upon the invitation of Council, before the Royal Dublin Society. By W. F. Barrett, Esq., Natural Science Master at the International College, London, &c.

[On Friday, January, 3, 1868, a highly interesting lecture was delivered, upon the invitation of the Council, by W. F. Barrett, Esq., Lecturer on Physical Science at the International College, London, &c., on Musical and Sensitive Flames, of which the following is an abstract]:—

One of the earliest natural facts which arrests the attention of a thoughtful mind is the stability of the wonderful universe in which we live. This permanency is, nevertheless, the product of incessant change; for nothing is absolutely at rest. The secret of the stability of nature, its unresting repose, is found in the fact that the motion is regular—the change is periodic. Atoms as well as planets have their period of revolution. Hence, sooner or later, in the physical world at any rate, phenomena repeat themselves. Like a vast living body the throbbings of the universe announce the accord of its varied parts. This rhythmic flow of nature constitutes most literally the "Music of the Spheres;" not this, but a less ethereal music I have had the honour of being invited to bring before you this afternoon.

The so-called musical or singing flames were discovered nearly a century ago by a native of this city, Dr. Higgins, who found, that when a flame of hydrogen was burning within a glass tube the flame emitted a musical note. The experiment was repeated; and it was, moreover, shown that glass tubes were not necessary, for similar sounds, though of different quality, were produced when metal or pasteboard tubes were employed. Neither was it necessary to use hydrogen, for a small flame of common coal gas gave a musical note when burning within a tube.

The cause of this phenomenon had been investigated by many, but most successfully by an illustrious man who had lately passed from among us—a man who had left behind him a name as good as it was great, and who possessed a mind as simple and child-like as it was sagacious and profound—the late Professor Faraday. This subject had been one of Faraday's early *flames*. The cause was shown to be due to the fact that the gas, in issuing from the burner, did not burn silently. It rustled in passing through the orifice of the burner, and in burning it made a continuous series of inaudible explosions. This was proved by several experiments; for, by suitable means both these causes could be exalted so as to become sensible. The resonance of the tube placed over the flame renders audible all the sounds of a certain pitch made by the gas. By a series of experiments it was then proved that any noise, if made regularly and with sufficient rapidity, was converted into a musical note. Thus rough and rude taps and hard and harsh explosions could be chased into perfect melody by mere rapidity of succession.

The condition of the flame when burning within the tube was shown by a moving mirror. It was seen that when the flame was silent, and the mirror moving, a band of light was produced, but when the flame was sounding, this luminous ribbon was broken up into a series of disjointed images of flame. The effect of lengthening the tube in which the flame was burning was next shown, and a series of gas jets burning within glass tubes of varying length gave a corresponding series of musical notes of varying pitch. By placing the finger upon the top of these tubes the sound could be quenched, and thus a novel musical instrument could be constructed. From glass tubes the lecturer passed on to show the effects of flames burning within extremely long tin tubes. Within a tube six feet long, and about one and a-half inches in diameter, the flame of a large gas burner gave a loud unmusical roar. By adding to the end of this tube a glass chimney, it was seen that when the flame was sounding it was broken up into wild confusion. By enclosing a still larger gas flame from a huge Bunsen's burner within a tube 18 ft. long and 3 in. diameter, a deep roar was obtained, intermingled with loud reports, similar to the discharge of musketry.

Returning once more to the gentler music of the small glass tubes, two flames, enclosed in their respective tubes, were taken and made to emit notes of the same pitch. This point was gained by shifting to and fro a paper slider, which moved stiffly at the upper extremity of one of the tubes. When the notes were nearly in unison, a series of intermittent sounds or *beats* were obtained, due, as is well known, to the mutual extinction at certain intervals of the two sounds. Corresponding beats were obtained from two organ-pipes and two tuning-forks nearly in unison. One of these tuning-forks, mounted on its resonance case, being silent, the other, unmounted, was now struck, and its prongs brought near to, but not touching those of the first fork; at first no sound could be heard, but by degrees the unmounted fork transferred its motion to the mounted one, and the sound of the latter slowly welled forth. The sound of the voice can thus be transferred to the strings of a pianoforte, and in the same way a flame can be made to accept and resound to a note of the proper pitch. This was illustrated as follows:—A singing flame, by adjusting the paper slider, was tuned to the note of a certain fork; the tube was then raised slightly, so that the sound could be quenched by momentarily placing the finger on the top of the tube. On now striking the fork, and holding it over a resonant jar, the flame instantly started into song. The same effect was shown by the syren and also by the human voice. Retreating to some distance from the flame, the latter could be made to respond at pleasure, by pitching the voice to the proper note, whilst it remained utterly unaffected by any note not in unison with itself. Musicians would find such a flame a faithful monitor in training the voices of their pupils.

In the last experiment we have really a sensitive flame; but this name is now applied to another discovery, which was made in the following manner:—Two years ago (December, 1865), whilst engaged in some acoustic experiments, the lecturer had observed that every time a shrill note was produced, a tall tapering gas flame in his vicinity was singularly affected; the flame shrinking every time the note was sounded. That observation led to further experiment and inquiry, the result of which has been the discovery of the conditions of success for obtaining flames sensitive to the slightest sound. Some months after the above observation, Professor Tyndall took up the subject, and having largely added to its interest and importance, offered an explanation of the phenomenon in a lecture delivered at the Royal Institution in January, 1867. At this lecture the discovery was first published, and the name given to "Sensitive Flames." Subsequently the lecturer had proposed a fuller explanation, and had discovered that not only flames, but all gases could be rendered extremely sensitive to sound—the track of the gas being marked by mixing it with smoke.* This historical notice would be unjust without referring to an observation made ten years ago in America by Professor Leconte. That physicist had noticed that certain sustained sounds in an instrumental concert caused a very perceptible movement of the ordinary gas flames in the room. This observation is really the germ of the more wonderful effects afterwards independently discovered by the lecturer. Though Professor Leconte was the first to publish the fact, in 1858, it appears that, previous to this date, artisans had frequently noticed the phenomenon as resulting from the shrill sounds of their work; and several musicians have informed the lecturer that the same effect has been one they have commonly observed.

Turning now from scientific history to experiment, the lecturer showed various kinds and degrees of Sensitive Flames. First, a "batswing" flame, which, under the ordinary gas pressure, moved slightly at the sound of a whistle, but thrust out long tongues of fire when the pressure was increased by urging the gas from a holder. This increased pressure was always necessary to obtain the more sensitive flames, for a reason that will be understood directly. A jet of gas, issuing from a V-shaped orifice, was shown to be quite insensible to sound until the flame reached a height of ten or twelve inches, and then, at the sound of certain high notes, the flame shortened and spread out into a fan-shape. Whistling to this flame in one key had no effect, while in another the effect was very marked. Playing an air upon a so-called bird-organ, the flame selected the high notes, and promptly shortened at their recurrence.

The probable cause of the sensitiveness of these flames was then alluded to. The impact of air evidently had nothing to do with the phenomenon. This was strikingly shown in the following experiment:—By tapping a membrane stretched over the mouth of a large tin funnel, a puff of air could be driven with such force from the narrow extremity that a candle was easily extinguished some twelve feet away. Directing this puff of air against the sensitive flame, it was seen that the flame moved violently, but was utterly unaffected when the puff was driven either to the right or left. This should also be the case if in former experiments it were the impact of the air, and not the sound that produced the effect. But it was at once seen that when the lecturer whistled, at the same time slowly turning round, the flame still continued to shrink, and was almost as powerfully moved when the back was turned to the flame. The effect, then, is solely produced by the wave-like to-and-fro motion of the sonorous pulses. As first indicated by Professor Leconte, a gas flame, to be sensitive, has to be brought near its point of roaring; it then stands, according to Dr. Tyndall, as it were on the brink of a precipice, over which the sound pushes it. Agreeing with this explanation, that a sensitive flame is a body in a state of unstable equilibrium, the lecturer supplemented it by comparing the flame to a resonant jar; the flame, as was proved, being in a state of rapid isochronous vibration when under the influence of external sound. The actual shrinking of the flame was due to an increase in the velocity of the current of gas, which was possibly brought about by an external sound throwing the pipe that conveys the gas into a state of vibration, which would thus narrow the channel of the gas passage: the change in the aspect of the flame being largely modified by the shape of the burner.

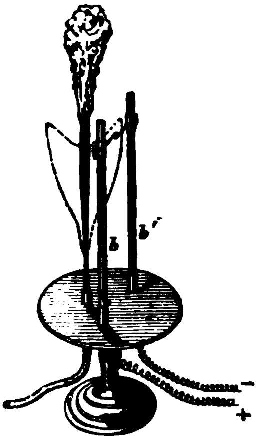
---

* "Philosophical Magazine," March and April, 1867.

Whatever may be the complete explanation of the phenomenon, there can be no doubt that in a somewhat similar manner other objects besides flames are also sensitive to slight external impulses. Thus, many chemical compounds, as, for example, fulminating powders, are in a state of unstable equilibrium. The so-called "Rupert's Drop," which, when scratched, flew into a thousand fragments, is another instance of this kind; and some of the most eminent physicists are inclined to believe that the surface of our sun is in a somewhat analogous sensitive condition. From inorganic things we may travel on to organic; for we have evidence that there also exists in organized structures a more or less sensitive state at certain times. Thus, our wonderfully complex bodies, by disease or nervous derangement, are often thrown into an abnormal state, and when in that condition are sensitive to the slightest stimuli, if of the proper kind. This may possibly be the foundation for whatever truth there is in the science of homœopathy, the body being sensitive to a feeble influence, similar in kind to the disease under which it is suffering.

Here some may ask, Of what good are these speculations, and to what practical end can these experiments be turned? This observation, permit me to remark, is wholly improper. There is something nobler in life than the accumulation of wealth, and a higher end to experiment than its mere momentary value; for all accession to knowledge must finally benefit the world. This ever intrusive exclamation *cui bono* is a serious check to the advancement of knowledge, for it disheartens those who are making nature yield up her secrets, and it damps the ardour of every searcher after truth. Allow me to illustrate my meaning. Imagine that when enchanted by the performance of some well-executed opera or oratorio, a companion by our side were to say—"Well, after all, of what good are these fine sounds; to what practical end can you turn this music?" Should we not instantly condemn a speech so characteristic of a sordid and sensuous mind? And when the student of nature is listening with admiration and even awe to the sweet, though silent, music sung to him by every object of his diligent study—by air and water, by flowers and flames—he is conscious that he bows before an oratorio as far above that of Handel as the works of the Creator are superior to the composition of the creature.

Still, however, the lecturer was enabled to show a practical application of these sensitive flames. Attention was drawn to the fact, that the flame shortened and spread out laterally under the influence of a whistle. Advantage was taken of this peculiarity to construct an instrument which may be turned to some practical use. The instrument consists of two sliding brass rods; attached at right angles to the summit of one is a compound metallic ribbon, consisting of thin layers of silver, gold, and platinum, welded together This arrangement expands unequally by heat; by so doing it swerves aside, and is thus brought into contact with a platinum point projecting from the top of the second brass rod, which is fixed about half an inch from the free extremity of the compound metallic ribbon. Connected with the two brass rods is an electric battery, associated with which is an electric bell, placed in a far distant part of the room. The bell will immediately ring if the electric circle be complete, but at present there is a gap in the circuit between the metallic ribbon and the platinum point. "I now ignite," said the lecturer, "a sensitive flame, which, in its ordinary state, burns at about two inches from the compound metal ribbon. I retreat some thirty feet from the flame, and whistle; the flame



at once responds; it shrinks and spreads out sideways. By so doing it comes in contact with the metal ribbon; the latter instantly springs aside at the warm touch of the flame, strikes against the platinum point, completes the electric circuit, and there you hear that distant bell answering me every time I whistle." In the same way, at any hour of the night, the crying of a child in its cot would automatically announce itself in its parent's room. By a somewhat similar arrangement, using, however, a different burner, a burglar, filing the iron-cased doors of a jeweller's shop, could be made to sound an alarm-bell; and it is even possible, by making use of the propagation of sound through water, the reflection of that sound through a trumpet immersed in the water, and its conduction to a sensitive flame, shut out by non-conductors of sound from the noises on board ship, that an arrangement might be constructed by which the approach of a vessel in a fog might be detected by ringing a bell in the captain's cabin. It is not, however, my province to develope such inventions. With diffidence I throw out these suggestions, which may, I trust, by the practical mind be in some way turned to the public good. *

The lecturer had reserved for the conclusion a flame wonderfully sensitive to the slightest noise. The burner which gave this flame was formed of steatite, and consisted of a single circular orifice, through which the gas was forced from a large holder in the lecture room, with greater pressure than could be obtained from the main. The flame was now fully two feet in length, and observe, said the lecturer, how delicate and fragile a thing it appears to be; for at the slightest noise it drops down a foot.† The jingling of this bunch of keys, the crumpling of this paper, the dropping of a small coin, are more than sufficient utterly to break up its height and symmetry. This flame makes no response to the vowels O, U, nor to the labials, but it energetically responds to the sibilants. Repeating the stanza—

> "Roll on, O rill for ever!
> Rest not, lest thy wavelets
> Sheen as shining silver—
> Shrink and sink to darkness."

The flame is unmoved by the first line, but emphatically bobs at the sound "rest" and "lest," and admirably suits its action to the words of the last line, for, when shrinking, the light of the flame almost disappears. So sensitive is this flame, that even a chirp made at the far end of the room brings it down more than a foot. Like a living being, the flame trembles and cowers down at a hiss—it crouches and shivers as if in agony at the crisping of this metal foil, though the sound is so faint as scarcely to be heard; it dances in tune to the waltz played by this musical box—and, finally, it beats time to the ticking of my watch. How wonderful are all these facts! And the more we know of them the more wonderful do they appear; for this astonishing change in the aspect of the flame is produced by an infinitesimal portion of those almost inaudible sound-waves, already enfeebled by their distance from the flame. Looking back on these, and innumerable other wonders revealed by

---

* Several of the laws of acoustics may be illustrated to a large audience by means of the sensitive flame next to be described. Placing, for example, a watch in the focus of one concave mirror, and a sensitive flame in the focus of a distant second one, the reflection and convergence of sound is seen by the regular beating of the flame to every tick of the watch. The decay of sound, and the prevention of that decay by tubes, can also be shown in a similar way. Many other illustrations of acoustical phenomena at once suggest themselves. I hope shortly to publish some further applications of this novel *phonoscope*.

† It is easy to see how a modification of the instrument just described can be, and has been, applied to this flame. The diminution of heat arising from the falling of the flame can cause the compound ribbon now placed above the flame to *recoil* upon the other battery connection: or, another arrangement may be employed—an air-thermometer having a bent stem, in which are sealed asunder platinum terminals; the circuit being closed by the backward movement of mercury in the tube, owing to the contraction of the air in the bulb.

physical science, and looking forward on that vast region which remains to be explored, do we not feel ourselves sinking to utter significance by contemplating the mysteries by which we are surrounded; whilst at the same time are we not conscious there is that within us still more wonderful than that without—a consciousness which lifts itself above all phenomena, grand and mysterious though they be?—W. F. B.

[Dr. Carte, the Director of the Natural History Museum, and Dr. J. Emerson Reynolds, were, on the recommendation of the Committee of Natural History, requested by the Council to visit the principal Museums in England and on the Continent. The following is an abstract of their report]—

ABSTRACT OF A REPORT ON CONTINENTAL MUSEUMS.

By Alexander Carte, M. D., Director of the Museum of Natural History, and J. Emerson Reynolds, Keeper of the Minerals.

In this Report the Director of the Museum and the Keeper of the Minerals give the results of their observations of the construction, arrangements, and mode of support of the museums of Paris, Strasburg, Heidelberg, Darmstadt, Frankfort, Bonn, Leyden, and Brussels. This tour of foreign institutions, devoted to the collection and exhibition of zoological, geological, and mineralogical specimens, was undertaken by the direction of the Natural History Committee, in order that the information gained during such inspection might be made available for the improvement of the Natural History Museum of the Royal Dublin Society. The reporters enter minutely into the details of the construction and arrangements of each of the museums already specified, and discuss the relative advantages of the modes of lighting, the distribution of cases for specimens, and the classification adopted in the several institutions, as well as the extent and value of the collections. The following description of the arrangements of the Jardin des Plantes and Ecole des Mines of Paris may be here introduced as illustrating the principle of centralization adopted in most continental cities.

"On the 16th of July we visited the Jardin des Plantes, where we were most kindly received by M. Jules Verreux, the Conservator of the Mammalian and Bird departments of this institution, and by whom we were conducted through the greater part of the Museum. The bird gallery is a long, rather low room, situated at the top of the building; it is lighted by means of semicircular windows, placed over the cases, partly in the roof and partly in the side walls, and these are furnished with blinds to moderate the light. The cases for the exhibition of the birds are placed round the room, against the walls, the specimens being arranged in them according to their respective orders, families, genera, and species. The collection is a very large one, and necessarily, from want of space, much overcrowded. It contains many rare and beautiful specimens, among which we noticed the *Psittacus pygmeus*, from New Guinea, described by MM. Quoy and Gaimard. This pretty little bird, the smallest of the parrot tribe, is not quite so large as our common bullfinch. Along the centre of this gallery the conchological collection is displayed in upright cases, with sloping glass sides, the specimens being arranged in tiers on shelves constructed like steps of stairs. Underneath these upright cases are lockers containing drawers to hold the duplicate specimens; in the spaces between those for the shells are placed octagonal cases, in which the *Trochilidæ* are exhibited. Both these collections are very fine, and well arranged; the birds, as we have already mentioned, being under the superintendence of M. Verreux, the celebrated ornithologist. The mammals are placed in the story beneath that in which the birds are contained; the room is, therefore, of similar length and breadth with the bird room, and is lighted in a somewhat similar manner. The mammals are arranged in glass cases along the walls, in accordance with the classification of the late Baron Cuvier. The specimens are beautifully mounted, and, like the birds and other collections in this institution, so very numerous, that any attempt to describe them would, under present circumstances, be almost impossible. Along the centre of this gallery, or room, cases are placed in which the *Reptilia* are arranged; but here, from want of space, the specimens are greatly overcwrowded, many of the larger reptiles being suspended from the ceiling. The great extent of the collection is, however, scarcely to be wondered at when we consider the amount of encouragement to the pursuit of all matters pertaining to the Natural Sciences in France, and also the numerous exploring expeditions under Government auspices, which have from time to time been sent to different parts of the world, accompanied by men of the highest acquirements in their several departments, and whose collections, when brought to Paris, have enriched the National Museum with objects of great beauty and rarity. In addition to the usual suite of rooms occupied by the taxidermists engaged in preparing, preserving, and stuffing the various specimens, there is a room set apart containing cabinets of unstuffed skins for the use of those engaged in the study of species. This is a most advantageous arrangement, as it prevents the necessity of disturbing the specimens exhibited in the Museum. Completely separate from this part of the building is the Entomological department, including the work rooms for setting up the specimens, all being under the charge of M. Emile Blanchard, Professor of Entomology, in whose absence we were most courteously received by M. Hippolyte Lucos, one of his assistants. The collections are very extensive, and are arranged in the usual manner in cabinets placed round the rooms; in the special work room attached, the assistants were engaged in preparing, setting, and naming the several specimens belonging to this section of the Museum. We next visited the Geological department, which is contained in a large and handsome building, to which the Botanical Museum is attached. We were here introduced to M. Delafosse, Professor of Geology and Mineralogy, and M. Milne Edward, Professor of Palæontology; both of whom, in the kindest manner possible, afforded us every facility for examining the extensive collection under their direction. In the large hall in which these are contained, the rock specimens and minerals are arranged in neat cases placed round the walls, having lockers, with drawers beneath each case for the reception of duplicate specimens. The minerals are very fine, and arranged according to the mixed chemical and morphological system at present so much in use. A gallery runs round the room, with glass cases along the walls, in which the fossils are arranged; the advantage of exhibiting in a distinct room the mineralogical and geological collection is strikingly shown in the great facility with which the student can examine in their proper order the valuable and well arranged collections of this museum. The chief interest, however, centres in a pyramidal-shaped case placed in the entrance hall, which contains Haüy's original collection of minerals, arranged according to his system. Apart from this being the collection of one of the chief mineralogists of his time, it has a special value, since many of the specimens here exhibited cannot now be obtained. Leaving the geological collections, we next visited the veteran, M. Serres, Professor of Comparative Anatomy, since deceased, with whom we had an interesting conversation in his special branch of study. On taking leave of him we went to the laboratory of M. Chevreul, whom we were not fortunate enough to find at home; in the absence of the Professor of Applied Chemistry, however, we were most courteously shown the laboratory by M. Cloez, M. Chevreul's assistant, who is himself a very distinguished chemist. The laboratory is small, but remarkably well furnished, and conveniently arranged, with a fine lecture theatre attached. We were equally unfortunate in not finding M. Frémy at home, but were enabled to examine his fine chemical laboratory with care. This is one of the neatest and best appointed laboratories which we have ever seen, and here we observed in use many pieces of apparatus which we hope to see introduced into the practice of analytical chemistry in this city. In addition to the admirable arrangements adopted here, there was one matter which we particularly noticed as being well worthy of imitation in all chemical laboratories where exact mineral or other researches are in progress. We allude to the fact, that all the working benches were covered with slabs of white glazed earthenware, thus permitting all operations to be performed with the most perfect cleanliness, and the occurrence of the slightest loss during the operation to be at once detected, as well as possessing other advantages which we will not dwell upon. It is in this fine laboratory that most of M. Frémy's remarkable chemical researches have been carried out.

We spent most of the following day in examining the collections at the Ecole Imperiales des Mines, which are of great interest to the mineralogist and geologist. The mineral and geological specimens are arranged in a spacious room, measuring about 250 feet long by 80 feet broad; this is divided into compartments by long, upright glass cases, extending partially across the room on each side, leaving a central passage; the interspaces are occupied by table-cases. The room is well lighted by windows along the southern wall; light is also admitted at each end, but not in the northern side. The western end of this Museum is devoted to the geological collections alone, the chief rocks being arranged in their proper orders, together with the fossils characteristic of each formation. In the glass cases forming the divisions of the remaining half of the room are placed the chief rocks, according to the localities in which they are found; thus, the rocks for the district of Ardeche are grouped together, and so on for the other departments. The minerals occupy the table cases in this part of the hall, and form a very rich and most valuable collection. It is only necessary to mention that the geological and mineral departments are under the care of Professor Daubree, to render it evident that all the resources of modern science have been brought to bear on these subjects in order to insure implicit accuracy and convenience of arrangement. We may mention that the classification is essentially chemical, and not morphological; each element, so far as possible, and some of its primary compounds, are placed in cases on one side of each compartment, and the centre table-cases are occupied by specimens of minerals, into which the same element enters as a more or less essential constituent. This plan, being from its very nature defective, is used merely as an adjunct to the general system, and not as a strict basis of classification. The most remarkable minerals exhibited were—the tin oxides in splendid crystals; gadolonite, particularly fine; red oxide of zinc; arseniates and blendes. Complete and good collections of iron and titanium ores, also gieseckite and triphane, far surpassing in beauty any specimens we have hitherto seen. The palæotological collection is shown in a room above that which we have already described, but it is only in process of formation.

"In the celebrated Museum of Leyden alone, was any feature of importance in connexion with Agricultural Science noticed. Here, a series of soils from the several districts, together with the rocks from which they were probably produced are exhibited, together with detailed analys is of the former, so that the farmer, on visiting the museum, can readily ascertain the general characteristics of the soil of his district without his being obliged to incur the expense of having his own samples specially analyzed. The advantage of such a system in an agricultural country such as Holland is too obvious to need more than a passing allusion. The primary result of this tour of Continental Museums has been the accumulation of a large amount of information relative to the best modes of construction and lighting of buildings suitable for the reception aud display of Natural History and mineralogical specimens, and a knowledge of the measures adopted by foreign governments for procuring supplies of specimens; and, secondly, the establishment of such friendly relations with the curators of continental collections as will, it is hoped, result in considerable advantage to the Natural History Museum of this Institution.

"Signed,

"ALEXANDER CARTE, M. D.,
"EMERSON REYNOLDS."

DISTRIBUTION OF PRIZES TO THE STUDENTS OF THE SCHOOL OF ART.

The Annual Distribution of Prizes awarded to the Students of the School of Art took place in presence of a large assembly, in the Lecture Theatre on Monday, December 23rd, 1867.

His Excellency the Marquis of Abercorn, Lord Lieutenant of Ireland, who was received by the Council and Fine Arts Committee, took the Chair as President of the Society.

His Excellency was accompanied by the Ladies Hamilton, and attended by the Hon. G. L. Dillon, Gustavus W. Lambert, Esq. (Comptroller), and the Aid-de-Camp in Waiting.

Right Hon. Lord Strathnairn, G. C. B., K. S. I., Commander of the Forces in Ireland, attended by his Aid-de-Camp, was also present.

Laurence Waldron, D.L., one of the Secretaries of the Society, thanked his Excellency for the honour he had done them in attending. He explained that the prizes for distribution were of three kinds—first, the prizes of the Science and Art Department; next, the Taylor prizes; and lastly, the prizes given by the Society. As to the prizes given by the Science and Art Department, he would say nothing. The Taylor prizes were the production of a bequest left by Captain Taylor of £2,000 for the promotion of art in Ireland. These prizes are limited to Irish-born students, or to those who had studied for two years in the schools of Ireland, and who gave promise of future excellence or advancement; the Society's prizes supplementing those of the Science and Art Department, were taken from the private subscriptions of the members. The Government gave no contribution to the promotion of art in Ireland. He believed his Excellency would be satisfied that, perhaps without exception next to the school in Kensington, their school in Dublin held the highest place of any in connexion with the Science and Art Department. He then called on Colonel Adamson, Chairman of the Science and Art Committee, to read the report.

Lieut.-Colonel Adamson expressed, in the first place, on behalf of the Committee, their thanks to the Lord Lieutenant for the honour of his Excellency's presence on such an interesting occasion; and it would, he said, enhance the value of the prizes in the eyes of the students who received them from his hands. It would be observed with pleasure from the report, that there has been a growing taste amongst the lower and middle, as well as the upper classes, for the study of the arts taught in that school, which were so well calculated to humanize and cultivate their minds. In that establishment they had almost every kind of pupil, and the instruction was of the very best character. In the presence of his Excellency he wished to express the high opinion entertained by the Committee of the zeal and talent of the head master, Mr. Edwin Lyne. He regretted that they were only the recipients of what were called payments upon results of the very large sum voted to the Science and Art Department by the liberality of Parliament, for the encouragement of science and art. For this central school of the Irish metropolis, in which there were between 400 and 500 pupils, and through the instrumentality of which nearly 3,500 pupils are being taught, they had no special grant. It was true that in this respect they did not differ from Edinburgh, and he thought that the present was a suitable opportunity for publicly expressing their earnest hope that the metropolitan schools of both Ireland and Scotland might, ere long, each have some reasonable grant made to meet the expenses of those establishments.

REPORT OF THE CHAIRMAN OF THE FINE ARTS COMMITTEE FOR THE YEAR 1867.

In presenting the Report for the year 1867, it is with pleasure and satisfaction that I have again to call your attention to the continued prosperity of this valuable Institution, and the great success that has been achieved by our Students in severe competition with those of the other Art Schools of Great Britain, at the national competition for advanced studies in Fine and Industrial Art, consisting of works in drawing, painting, and modelling in clay. The premiums granted by the Department of Science and Art to those successful in this competition are the reward of high talent in the Art Student, and tend to excite and stimulate him to further efforts and higher aims. Many of our Students exhibit ability and industry which, if well sustained, accompanied by earnestness and high motives, may lead them to a distinguished position in Art. The medals, prizes, and certificates, that are on the present occasion to be distributed, have, in every case, been gained at Competitive Examinations, four of which take place annually: 1st, a local and personal examination by means of time exercises of the second grade, consisting of Practical Geometry, Freehand Drawing, Perspective, Model Drawing and Projection: the papers are furnished by the Department of Science and Art, and are returned, after being filled in by the Students, to South Kensington for inspection. This examination is conducted by Members of the Council and Fine Arts Committee, and is of the highest importance as testing the proficiency of the Pupil in the elementary practice of Drawing, and also in those fundamental principles, a knowledge of which is so essential to a successful prosecution of Art. 2nd. An examination in London of the works executed in the ordinary course of study for prizes of the third or highest grade. 3rd. An examination also in London of a selection of the best works for competition, with similar works from all the Art Schools in the kingdom; this is known as the National competition. 4th. A local competition of works, chiefly of an advanced character, for the medals offered by the Royal Dublin Society.

As regards elementary drawing taught in schools in and about Dublin, through the instrumentality of teachers from this School, the number receiving such instruction has been about 3500; the annual examination of these Schools took place in May; the importance of elementary instruction in drawing in Schools, generally, as a branch of education, cannot be too much urged and insisted on as being calculated, in the course of years, to influence and develope the taste of the people, and to lead to the demand, production, and appreciation of that which is true and beautiful in Art and Art-manufacture.

The attendance of Students during the year has been:

Day Classes:		
Ladies, ...	188	
Gentlemen, . . .	67	
		255
Morning and Evening Artisan Classes:		
Males, ...	167	
Females, ...	10	
		177
		432

Males, 234. Females, 198. Total, 432.

The fees have amounted to £458 5*s.* 10*d.*

The following is an Analysis of the Occupations of Students (in cases of Students without a trade or profession, that of their parents is given):—

Agents, 5; Architects, 10; Army Officers, 14; Artists, 21; Art Teachers, 3; Auctioneer, 1; Bankers, 3; Bank Manager, 1; Barristers, 14; Book Binder, 1; Boot Maker, 1; Builders, 15; Butcher, 1; Butler, 1; Cabinet Maker, 1; Carpenters, 14; Carvers in Stone, 2; Carvers in Wood, 3; Chemist, 1; Civil Engineers, 7; Clergymen, 19; Clerks, 37; Coach Painters, 2; Coach Trimmer, 1; Commercial Travellers, 3; Dentists, 2; Drapers, 6; Draughtsmen, 2; Druggists, 3; Dyers, 2; Editors, 4;

Engine Fitters, &c., 5; Engravers, 5; Grocers, 6; Gun Makers, 2; Hatter, 1; House Painters, 8; Ironmongers, 5; Jewellers, 2; Joiner, 1; Judges 8; Knight, 1; Labourers, 2; Landed Proprietors, 17; Law Student, 1; Leather Dressers, 4; Letter Carriers, 2; Lithographers, 6; Magistrates, 6; Medical Doctors, 26; Medical Student, 1; Members of Parliament, 2; Merchants, 19; Mine Owner, 1; Mining Engineer, 1; Moulders' Pattern Maker, 1; Newspaper Proprietor, 1; Optician, 1; Peer, 1; Photographers, 5; Picture Restorer, 1; Police Superintendent, 1; Poulterers, 2; Professors, 8; Royal Engineer, 1; Saddle Tree Maker, 1; Salesmen, 3; Sculptors, 8; Silver Smiths, 2; Solicitors, 22; Stained Glass Manufacturer, 1; Students unspecified, 40; Tailors, 3; Teachers, 18; Upholsterers, 5; Watch Maker, 1.

The local examination took place on the 12th, 13th, and 14th days of March, when 117 Students presented themselves, 67 of whom succeeded in passing in 98 papers of the second grade; of these 67 Students, 37 were males, and 30 females.

The subjects consisted of Geometry, Perspective, Freehand and Model Drawing, and Projective; one hour was allowed for each paper.

Three Students are worthy of special mention, as having passed in the four subjects required in order to obtain the full certificate, viz.:—Frederick William Burton, Charles Thomas Fishe, and Edward Gibson; twelve Students completed the papers necessary to obtain the full certificate, viz.:—Charlotte E. Benson, Diana Sullivan, Annie J. Banks, Margaret Hart, Charlotte Kenny, Ruth E. Nicholson, Charles Thomas Fishe, Frederick William Burton, Edward Gibson, Alexander Robinson, Joseph Watkins, and Henry Edward Hall.

The following gentlemen, Members of the Council and of the Fine Arts Committee acted as Examiners upon this occasion:—Hon. George Handcock, Lieut.-Col. Adamson, John Shaw Smith, Esq.; Walter Lindesay, Esq., J. P.; Sir Robert Harty, Bart.; William M'Kay, LL. D.; Hon. Judge Berwick, Henry T. Vickers, Esq.; Frederick Darley, Esq.

The competitions of works in the various stages took place in London in March; the number of Drawings, Paintings, and Models forwarded from this School amounted to 156, and 48 were chosen for the National Competition—being a greater number than was selected from any other School. *The National Prizes consist of* 80 *Medals, and a very limited number of Queen's Prizes. And the entire number of Schools competing for those distinctions is upwards of* 100. *In this competition the Society's School was awarded* 6 *Medals, and* 3 *Queen's Prizes—in all* 9 *awards, being only surpassed in this respect by the South Kensington Schools.* The following are the names of the successful competitors:—Miss Frances Seymour, Miss Anna F. Ruxton, Mrs. Elizabeth Smith, Mr. Francis Walker, Miss Kate Seymour, Mr. Wm. Henry Murray, Miss Clara Bayly, Mr. Stephen Catterson Smith.

I beg to append here a table showing the number of works selected and awards made to this School in the London National Competition during the past five years:—

	Selected for National Competition.	No. of National Awards.
1863,	8	1
1864,	10	4
1865,	29	4
1866,	41	8
1867,	48	9

With regard to those works not selected to compete for national awards, fifteen prizes and four honourable mentions of the third, or highest grade, were gained, nine having been taken by male, and six by female students. The works of twenty other students were found satisfactory.

29 out of 100 Schools succeeded in obtaining medals at the national competition; and Dublin, as in 1866, is the only School in Ireland to which such awards have been made.

The examiners were Daniel Maclise, R. A.; Richard Westmacott, R. A.; J. C. Horsley, R. A.; Frederick Leighton, R. A.; Richard Redgrave, R. A.; and Henry Alexander Bowler, Esq., Official Inspector for Art. Those examiners, in their report, make special mention of the designs by our Students for the Poplin manufacture; some of which were executed by Messrs. Fry & Co. of this city, and were exhibited in the Universal Exhibition of Paris this year. It may not be out of place here to remark upon the omission of one feature in the great Exhibition that has so recently closed; I refer to the absence of any systematic arrangement of the works of Students of Art Schools of this and other countries; a display of such works, in juxta position, would have tended more than anything else to enable us to form a true estimate of the relative degrees of perfection attained by different countries in Art instruction, more particularly with a view to the improvement of those branches of manufacture which are susceptible of ornamentation, and the processes which unite artistic and manufacturing skill; such comparison would have been of the greatest advantage, not only to those immediately concerned with Art Education, but also to manufacturers and producers, who would do much to advance their interests were they to second more earnestly the efforts of the Schools generally for the improvement of design. They, however, relinquish the traditional patterns and processes with reluctance. There is even now a desire on the part of the public for design of a better kind than is generally furnished; for, by the teaching of Schools of Art and Exhibitions, the public taste has rapidly improved, and the general training in drawing, and the fixed and positive rules of Art, as Geometry, Perspective, Anatomy, Proportion, and Botany, have influenced the public taste to a higher appreciation of the beauties of nature and all renderings of it, whether conventional or otherwise.

The adjudication of Medals of the Royal Dublin Society took place on the 21st inst., Sir George Hodson, Bart., George H. Mulvany, R. H. A., and M. Angelo Hayes, R. H. A., acting as Judges.

165 Works were submitted in the following subjects:—

For Silver Medals.

No. of Works.	
10	Painting from the Life, in Oil.
9	Drawing of full-length Antique, shaded in Chalk.
15	Drawing of Head, Hand, and Foot, from Antique, in Chalk.
6	Modelling from Antique, and Life, in Clay.
27	Original Design for Manufacture.
4	Architectural Design.
2	Architecture from actual Measurement.
4	Anatomical Studies.
37	Landscape painted from Nature.

For Bronze Medals.

18	Group of Models, shaded in Chalk.
16	Sheet of Perspective Drawing.
5	Do. of Geometrical Drawing.
12	Do. of Orthographic Projection.

The particulars of the adjudication will be found in the appended Report of the Judges; and the names of Students successful in the National Competition, Competition for 3rd Grade Prizes, and Local Examination, together with the various subjects to which awards have been made, will be found in the list of distribution.

The Worshipful Company of Plasterers of London have offered four Money Prizes to be competed for by Students of Schools of Art, as follows:—

For a Model in Plaster suitable for the ornamentation of a Frieze in the Italian renaissance style,

For best design, ...	£8	8	0
For second do., ...	5	5	0

For an original design for a centre ornament for a ceiling, to be shaded to represent relief, either in chalk or monochrome,

For best design, ...	£7	7	0
For second do., ...	4	4	0

The Prussian Government have presented to the Society for use in the School, through J. Shaw Smith, Esq., their great work, containing fine examples, illustrative of the Arts of the Middle Ages, compiled by Beuth, the Director of the Gewerbe Institut of Berlin, for use in that and other Schools of Art in Prussia, and we have much reason to feel indebted for the exertions made by Mr. Smith to obtain them.

In conclusion, it is gratifying to remark the proficiency that has been attained by our Students, evidencing in their works a sound, complete, and practical training. As Students advance they are more open to the conviction that real excellence can only be attained by serious and sustained exertion and endeavours on their part; impatient study,—a desire to arrive at the end without a proper acquaintance with the means—is the chief obstacle to progress. Without a well considered plan, and efforts properly directed, much time may be lost on that which is trivial, or which is not calculated to lead so quickly, or so surely to the desired result. The proper work of the Student may be summed up in the study of the human form; and this is proper for all alike, whatever may be the branch of art it is ultimately desirable to follow. This is not merely an opinion, but a settled truth, and has been long evident to the greatest authorities of this and former times. The study of the living figure embraces both individual and aesthetic considerations—the former dealing with the real, the latter with ideal form—or as we can conceive it—free from injury or disease, including, as this does, the causes that conduce to the degradation of beauty, and departure from perfection; the mechanical considerations of the bony framework, and the muscular powers by which it is influenced, and the endless surface changes dependent upon the various positions of the body. Such studies try the powers, and elevate the mind. He who has acquired an aptitude of representing the human form has learned to read the most difficult book in Art; and since it is the most subtle in its contours, the most complex in its movements, and the lights and shadows, tints and hues, the most delicate, it follows, that, having gained a high degree of skill from the consideration of these, forms and proportions less perfect, and colour less refined, may be rendered with comparative ease.

It is almost needless to allude to the value of the study of antique works and remains: modern art is deeply indebted to these. Sir George Beaumont was of opinion that the "Apollo" and the "Venus" were worth thousands a year to the nations that possessed them. With our opportunities of gaining an insight into the causes that conduced to the perfection of Ancient Art, by means of the reproductions so widely spread over the country, we possess advantages that the Greeks themselves did not enjoy; with numerous collections of objects of Italian Art, and Museums and Exhibitions of those of Modern Art still more numerous, we have opportunities so great, that the chief difficulty to the Art Student seems to lie in selecting suitable works for study, and those most conducive to progress. I venture to advise Students choosing between two courses to draw from the Antique rather than copy even the finest pictures of the Masters; by directing the attention chiefly to form, by adhering to this essential, and not allowing the mind to be led from it by the fascinations and allurements of colour, or the conventionalities of touch and manner, a power, facility, and taste will result, necessary to an able rendering of living form. Such a course will lead to excellence, and to the production of works that may claim the admiration of future ages.

An Exhibition of the Works of the Students will be on view daily in the School of Art for the next fortnight, from 11 to 3 o'clock, and will be free to the public.

(Signed) J. S. ADAMSON, *Lieut.-Colonel, Chairman.*

December 19, 1867.

The ASSISTANT SECRETARY then read the following Report of the Judges of the Works executed in competition for the Prizes offered by the Society for 1867:—

REPORT

OF THE JUDGES OF THE WORKS EXECUTED IN COMPETITION FOR THE SOCIETY'S PRIZES.

We have carefully inspected the studies submitted to us this day, and recommend the following Premiums to be awarded to the respective Students:—

1. For the best Painting of a Head from the Life:—
   Miss Clara Bayly, ... *First Silver Medal.*
2. For the best Drawing in Chalk, of full length Antique Figure:—
   Mr. Stephen Catterson Smith, ... *First Silver Medal.*
   A Second Silver Medal recommended to Miss Elizabeth Jennings.*
   Mr. Edmund Byrne's Drawing of a Figure from the Antique much commended.
3. For the best Drawing shaded in Chalk.—Head, Hand, and Foot (Antique):—
   Mr. Michael Fitzgerald, ... *Second Silver Medal.*
   Honourable mention of Mr. Douglas Boucher.
4. For the best Anatomical Drawing:—
   Miss Elizabeth Irwin, ... *Second Silver Medal.*
5. Best Landscape of Irish Scenery:—
   Mr. Michael Fitzgerald, ... *First Silver Medal.*
   Second Silver Medal recommended to Mr. James Mac Donald.*
   And honourable mention to Miss Margaret Marquiss.
6. Best Model in Clay:—
   Mr. William Millard, ... *First Silver Medal.*
   And First Silver Medal recommended to Mr. Joseph Watkins.
7. Best Original Design for manufacture (Carpets):—
   Miss Kate Seymour, ... *First Silver Medal.*
   First Silver Medal recommended to Miss Minnie Mahony, for Chintz and Wall Decorations.*
   And Bronze Medal recommended to Miss Frances Brett, for Muslins and Wall Decorations.
8. Best Drawing of a Public Building:—
   Mr. Alexander Robinson, ... *First Silver Medal.*
9. Original Design in Architecture.—No Award.
10. Geometrical Drawing:—
    Mr. James Lynch, ... *First Bronze Medal.*
    A Second Bronze Medal recommended to Mr. Albert E. Murray.*
11. Perspective:
    Mr. Richard Dowling, ... *First Bronze Medal.*
    Mr James Lynch, ... *Honourable Mention.*
    A First Silver Medal was awarded to Miss Frances Seymour for the best Design for a New Royal Dublin Society's Medal.
12. Models in Chalk:—
    Miss Emily M. Burton, ... *First Bronze Medal.*
    Mr. Thomas Smith, ... *Second Bronze Medal.*
    Miss Susan Boxwell, ... *Honourable Mention.*
13. Orthographic Projection:
    Mr. Richard Dowling, ... *Bronze Medal.*

(Signed) George Hodson, Bart.
George F. Mulvany, R. H. A.
M. Angelo Hayes, R. H. A.

Royal Dublin Society,
December 21, 1867.

The Students named in the Report were each presented to his Excellency, the President, who delivered the Prizes to them.

The Prizes awarded by the Science and Art Department were next distributed by the President in the following order:—

---

* These recommendations have been confirmed by the Fine Arts Committee.

PRIZES AWARDED BY THE DEPARTMENT OF SCIENCE AND ART.

National Silver Medal.

Francis Seymour,	*Painting in Monochrone from the Antique.*

National Bronze Medal.

Anna F. Buxton,	*Designs for Silk.*
Kate Seymour,	*Medallion Head.*
Elizabeth Smith,	*Group in Colours.*
Elizabeth Smith,	*Drawing from the Antique.*
Frances Walker,	*Shading in Chalk from the Life.*

Queen's Prizes.

Clara Bayly,	*Group in Oil Colours.*
William H. Murray,	*Design for Wall Decoration.*
Stephen Catterson Smith,	*Drawing from the Antique.*

National Prizes.

Emily Burton,	*Freehand Outline of Ornament from the Flat.*
Sarah Barry,	*Freehand Outline of Ornament from the Round.*
Mary A. Magee,	*Shading in Chalk of Ornament from the Flat.*
Frances Brett,	*Do., Do.*
John William Kennedy,	*Shading in Chalk of Models from the Round.*
Henry E. Saunderson,	*Do., Do.*
Thomas Smyth,	*Do., Do.*
Sharland Hanly,	*Do., Do.*
Thomas Stringer,	*Do., Do.*
Annie J. Banks,	*Shading in Chalk of Ornament from the Round.*
James Kearney,	*Do., Do.*
Peter Hackett,	*Freehand Outline of the Human Figure from the Flat.*
Matthias Pigott,	*Do., Do.*
Margaret Hart,	*Freehand Outline of Flowers from Nature.*
Henry Edward Hall,	*Machine Drawing.*

Honourable Mention.

Frederick Burton,	*Freehand Outline of Objects from the Flat.*
Arabella Spencer,	*Do., Do.*
Mary A. Morgan,	*Shading in Chalk of Ornament from the Flat.*
Ruth E. Nicholson,	*Shading in Chalk of Ornament from the Round.*

Selections for National Competition.

Lizzie Langan,	*Shading in Chalk of the Human Figure from the Round (Antique).*
Stephen Catterson Smith,	*Do., two works.*
Elizabeth Bredin,	*Do., Do.*
Elizabeth Smith,	*Do., Do.*
Francis Walker,	*Shading in Chalk of the Human Figure from Nature, two works.*
Kate Langan,	*Anatomical Studies of the Human Figure.*
Clara Bayly,	*Do., two works.*
Mary Bredin,	*Painting in Monochrone of Ornament from the Cast.*
Francis Seymour,	*Painting Figure from Antique in Monochrone.*
Sarah Barry,	*Painting of Flowers in Water Colours from the Flat.*
James Macdonnell,	*Do., Do.*

Lucy Sharpe,	*Painting Flowers in Water Colours from Nature.*
Harriet M. Everth,	*Do., Do.*
Frances Seymour,	*Do., Do.*
Kate Seymour,	*Do., Do.*
James Macdonnell,	*Painting of Landscape in Oil or Water Colour from Nature.*
Elizabeth Smith,	*Do., Do.*
Kate Seymour,	*Do., Do.*
Anna F. Ruxton,	*Do., Do.*
Michael Fitzgerald,	*Do., Do.*
Clara Bayly,	*Painting Groups in Oil as Compositions of Colour.*
Elizabeth Smith,	*Do., Do.*
Frances Seymour,	*Do., Do.*
Kate Seymour,	*Do., Do.*
Edmond R. Byrne,	*Painting in Oil the Human Figure from Nature.*
Francis Walker,	*Do., Do.*
Ellen Furniss,	*Do., Do.*
Frances Seymour,	*Do., Do.*
Kate Seymour,	*Do., Do.*
Anna F. Ruxton,	*Drawing Human Figure from the Life.*
Joseph Watkins,	*Modelling the Human Figure from Nature, two Works.*
Kate Seymour,	*Do., Do.*
Henry E. Hall,	*Design for Machines.*
William H. Murray,	*Applied Surface Design, two works.*
Henry F. Thomas,	*Do., three works.*
Matilda Booth,	*Do., Do.*
Harriet M. Everth,	*Do., Do.*
Frances Jordan,	*Do., Do.*
Isabella Bergin,	*Do., Do.*
Anna F. Ruxton,	*Do., two works.*

Full Certificates (Second Grade)

Annie J. Banks.
Margaret Hart.
Ruth E. Nicholson.
Frederick Burton.
Edward Gibson.
Alexander Robinson.
S. Catterson Smith.
Joseph Watkins.
Charlotte Kenny.
Diana Sullivan.
Charlotte E. Benson.
Charles Thomas Fishe.

Second Grade Prizes.

Annie J. Banks,	*Perspective.*
Emily M. Burton,	*Geometry.*
Frederick William Burton,	*Geometry and Perspective.*
Isabella Burton,	*Geometry.*
Lucius H. Deering,	*Model.*
Richard Dowling,	*Perspective and Mechanical.*
Charles Thomas Fishe,	*Freehand, Geometry, and Perspective.*
Michael Fitzgerald,	*Geometry.*
Edward Gibson,	*Freehand and Geometry.*
Henry Edward Hall,	*Freehand.*
Margaret Hart,	*Perspective.*
Ellen Furniss,	*Model.*
James Mac Donnell,	*Freehand and Model.*
Katherine M. Macsorley,	*Geometry.*
James A. Martin,	*Geometry.*
Ellie T. Monsarrat,	*Geometry and Model.*
James Moran,	*Freehand.*
Matthew H. Moran,	*Freehand.*
Thomas Proctor,	*Geometry.*
Alexander Robinson,	*Model.*
S. Catterson Smith,	*Geometry.*

Second Grade Certificates.

Mary Abbott,	*Geometry and Perspective.*
Emanuel Appleyard,	*Freehand.*
Ambrose Baird,	*Freehand.*
Ismena Benson,	*Freehand.*
Isabella Bergin,	*Geometry.*
Mary J. Booth,	*Model.*
Emily M. Burton,	*Freehand and Perspective.*
Frederick William Burton,	*Freehand and Model.*
Isabella J. Burton,	*Freehand and Model.*
Josephine Carson,	*Freehand.*
Richard J. Cruise,	*Geometry.*
John Daly,	*Freehand.*
Henrietta D'Arcy,	*Freehand.*
Richard Dillon,	*Freehand.*
Joseph Donohoe,	*Freehand and Model.*
Richard Dowling,	*Geometry.*
Kate S. Ferguson,	*Model.*
Charles Thomas Fishe,	*Mechanical.*
Kate Fitzpatrick,	*Model.*
Elizabeth Gerrard,	*Freehand.*
John Gibbs,	*Freehand.*
Edward Gibson,	*Perspective and Model.*
Lizzie Gore,	*Model.*
Patrick J. Higgins,	*Perspective and Mechanical.*
Ellen Furniss,	*Freehand.*
James Kearney,	*Model.*
Robert Knox,	*Freehand.*
James Lauder,	*Model.*
Mary C. Lawlor,	*Freehand.*
Edmund Longford,	*Freehand and Model.*
James Lynch,	*Perspective.*
Maria Jane M'Comb,	*Freehand.*
Madeline M'Dermott,	*Model.*
Joseph M'Donnell,	*Freehand and Model.*
Minnie G. Mac Sorley,	*Freehand and Geometry.*
Mary Anne Magee,	*Geometry.*
Mary Anne Morgan,	*Model.*
James Moran,	*Model.*
Matthew H. Moran,	*Model.*
Ruth E. Nicholson,	*Model.*
William C. Nixon,	*Model.*
Lizzie Cecilia O'Neill,	*Freehand.*
Amelia Parkenson,	*Freehand.*
Anna M. Parnell,	*Model.*
Matthias Pigott,	*Freehand and Model.*
Isabella Pollexfen,	*Model.*
Thomas Proctor,	*Perspective.*
Linda Gordon Reede,	*Freehand.*
Henry Edward Saunderson,	*Freehand and Model.*
Robert Sidney Smith,	*Freehand.*
Stephen C. Smith,	*Perspective.*
Thomas Smyth,	*Freehand.*
Arabella Spencer,	*Freehand and Geometry.*
Charles Stewart,	*Freehand.*
Eugene Victory,	*Model.*

Joseph Watkins, ... *Model.*
John Butler Yeates, ... *Model.*

Two Scholarships of the value of £25 and £11, respectively, have been founded, and are called the "Princess of Wales's Scholarships," for the two Students who, being females, take the highest prize of the year in the National Competition of all the Schools of Art.

(Signed) Edwin Lyne, *Head Master.*

Taylor Art Scholarship.

A Scholarship awarded in 1867 to Mr. Joseph Watkins was this year renewed to him. No prizes were offered this year, in consequence of legal arrangements rendered necessary by the death of Charles E. Bagot, one of the Trustees of the Will.

Sir George F. Hodson, Bart., said, it now became his pleasing duty to return the thanks of the Royal Dublin Society to his Excellency for his kindness in having presided on the present occasion.

His Excellency then said—Sir George Hodson, Ladies, and Gentlemen, I beg to express my most sincere thanks for the very kind manner in which the vote of thanks has been passed to me for my attendance here this evening. I can assure you that it has given me the most sincere pleasure to be a witness of the successful proceedings of this institution, as well as the interesting ceremony by which it marks its approbation and appreciation of the successful candidates. The objects and purposes of this School of Art have been so fully explained by all those able speakers who have preceded me, that it is not necessary for me to dwell on them further than to allude to the very large and satisfactory number of successful students, which the list shows to be larger this year than in any of the last four years, with the exception of 1865. I must also allude to and congratulate you upon the very large number of successful lady students, which the list shows to be very nearly equal to that of the male competitors in the other grades and certificates: while in the national awards we find that the successful lady competitors are five as compared with three of the male students. Ladies and gentlemen, I really believe that, not only in other domains, where the ladies are assuming something more than an equality, but even in the dominions of art, the boasted supremacy of man is in some danger from his fair and captivating competitors. And however sensible I may be of the humiliation likely to fall upon my own sex, I should be the last to wish to pluck one leaf from the laurels that so well adorn the fair brows that have so worthily earned them. And I congratulate most heartily the ladies on their position and their victory. We all know that the poet sang that "Nature tried her 'prentice hand on man, and then she made the ladies," and as it was in nature so I believe it is destined to be in art. It is also very satisfactory to see the large number of artisans that have attended the schools of art here. I believe that, for the diffusion and spread of art, it is most essential that the artisan classes should be art students, and not merely the carriers out of the works of others. Great efforts have been made in this direction for the last few years, and we can only realize what the effect has been by looking back at what the general state of art was in the British Isles some twenty years ago—say, before the first Exhibition in '51, which was the first shock that awoke the self-satisfied Briton to the extreme ugliness, monotony, and want of artistic effort in his every-day surroundings. Since that time considerable efforts have been made in opening schools of design for a better acquaintanceship with the best models of foreign workmanship and the encouragement of artistic teaching for artisan students. But I believe that even more than this is required, in order to produce a real knowledge of high art—such art I mean as was prevalent in the middle ages—that still greater efforts are necessary. I believe that the facile production of our day, and easily attainable means—mechanical means of turning out a certain sort of art—the great facility given by machinery of imitating, or so to speak, reproducing acknowledged good models in an inferior form of workmanship, have a tendency to prevent the age we live in from attaining the highest point of art. I know this opinion may be considered heterodox, but I believe it to be correct. I believe the surest and most certain way of getting over this difficulty is the artistic teaching of the artisans themselves, that they should be artists and not merely workers. I believe the great deficiency of our day has been that, whereas we have very many and very able designers, modellers, artists, and so-forth, their designs are handed over for completion to workmen who are not artists. In short, the artists have not been workmen, and the workmen have not been artists. Hence their failure in not arriving at the highest point of art. I remember, in a conversation with one of the most eminent silversmiths in London, asking him how it was that some of the finest works in silver of the reign of Queen Anne, although reproduced by him in exactly correct mechanical models, were yet palpably inferior in grace and beauty to the original ones. His answer was—"I fully admit the fact, and the only way I can account for it is, that the men who worked on the originals were artists, and that ours are workmen." And he spoke the truth. The patterns were there, perfectly and mechanically accurate, but the grace, softness, and artistic touch of life were wanting. If you look to the middle ages, to the times of the men when what we call high art was in its zenith—I mean the period which witnessed the finest productions in precious metals, bronzes, ivory, enamels, the older potteries, &c., and even in paintings—you will find this by no means to be the case. The great artists of those days were also skilful handicrafts. Such men as John of Bologna, Michael Angelo, Benvenuto Cellini, Bernard Palissy, and a host of others, were not only the designers of their own works, but the workers of them, and were as skilful at their tools as the most skilled worker. The painters also, not content with the mere artistic portion of their pictures, were also the compounders and makers of their own colours, those marvellous colours which, after a lapse of three centuries, put to shame the colours of the present day, and of which the secret, in many cases, has died with the great artists who produced them. Ladies and gentlemen, I fear I am wandering too far into the region of high art. The inference, however, I wish to draw is this, that to produce in any country a real school of high art, and to give full scope to the development of artistic genius and originality in its highest form, as distinct from the mere servile imitation of acknowledged conventional models, it is essential that the artisan must be an artist rather than an artisan, and that the artist should combine the artisan. It is, therefore, with great satisfaction that I hail the increased number of artisan students in the School of Art of this institution. I believe, I may say, without being guilty of flattery to my present audience, and without wishing to depreciate the merits of art competitors of other countries, that the artistic spirit is a predominant element of the Irish character. It is not possible to have mixed with the peasantry of Ireland without having observed the strong, though, of course, unconscious feeling of poetry and love of the beautiful that is innate in them. As you go higher, of course this feeling is more developed and more refined. Here then you have the germ and instinct of artistic feeling, which merely requires cultivation and training to develope it into artistic excellence. I have been told by the superintendent of one—I believe the only Irish potteries—who had been manager of one of the largest china manufactories in England, that the artistic aptitude and intelligence of the youth of both sexes employed in Ireland far exceed anything he had known of the same class in England. This, I believe, would be found to be the case in most parts of Ireland. If I might venture to suggest any probable deficiency, and I do so with great diffidence, and under favour of my present audience, I should say the defect in the Irish element would not be the artistic feeling, but the skilled working power, whereas, on the other side of the water, the deficiency would be in the artistic spirit rather than in the workmanlike power. As you have been kind enough to take my little admonition in good part, I may add, by way of consolation, that I think, of the two phases, the Irish have considerably the advantage, and for this reason, that by training and perseverance skilled labour can be acquired, whereas the artistic spirit is a gift which can only be engrafted and engraved by the hand of nature. I believe that gift has been largely given to Ireland, and that, by efficient management and encouragement, it may greatly contribute both to the material prosperity and to the intellectual refinement of its people. It is for this reason I have had very great pleasure in attending at your Society this evening, and that I shall always, as far as lies in my power, endeavour to advance the art interests of Ireland.

After the termination of the proceedings, his Excellency proceeded to view the numerous and admirable display of Students' works in the School of Art.

EVENING MEETINGS FOR THE DISCUSSION OF SUBJECTS CONNECTED WITH SCIENCE AND THE ARTS.

Monday Evening, November 18, 1867.

William Andrews, Esq., Chairman of the Natural History Society, in the Chair.

Mr. W. F. Kirby, Assistant in the Museum of Natural History, read a paper "On the Extra-Tropical Regions of Europe." Published in the present Number.

Dr. De Ricci read a paper "On the Japanese Oak-feeding Silkworms." Also published in the present Number.

The Chairman drew the attention of the Meeting to the large number of Specimens of Zoology which had been placed on the table for exhibition, which were selected from a large collection recently purchased by the Society at Utrecht. The following is a list of the specimens exhibited:—

The King Vulture (*Sarcoramphus Papa*); the Tiger Bittern (*Tigrosoma Tigrinas*), *Merops amictus;* a white variety of the common Buzzard (*Butis vulgaris*); *Hierax cærulescens*, the smallest of the Hawks; the Hornbill (*Buceros cavatus*); *Ptilopus Jambu*, and several other interesting species of birds. Among the Mammalia were the black Leopard of Java (*Felis Leopardus*, var. *melas*); the little Musk Deer of Java (*Moschus jarvanicus*); several Monkeys, including *Presbytes maurus*, *P. Melalophus*, *P. entellus*, *Stentor Seniculus* (the Howling-Monkey of South America), &c.; *Tarsius spectrum*, *Antilope Dorcas* (var. *Alba*).

There were also on the table two specimens of the beautiful Coral Sponge (*Euplectella Aspergillum*, which has been called "Venus's Flower Basket," and a fine specimen of the Fusion Sandstone from Delhi, presented by Leonard Dobbin, Esq.

Monday Evening, December 16, 1867.

William Barker, M. D., in the Chair.

Dr. J. Emerson Reynolds, Keeper of the Minerals, read a paper "On the Use of the Spectroscope in the Analysis of Minerals." Published in the present Number.

Mr. Thomas Dillon read a paper "On a new Method of Flushing the City Sewers" by means of a Reservoir, to be filled from the sea, and allowed to empty itself through the sewers.

Dr. J. M. Barry exhibited an undescribed Species of Lizard, found in a salt swamp in South Australia; also a specimen of Gold Quartz, presented to the Society by Mr. Bagot, of Adelaide; and a specimen of a Gorgonia.

Monday Evening, January 28, 1868.

Sir D. J. Corrigan, Bart., in the Chair.

Wm. Andrews, Esq., Chairman of the Natural History Committee, read a paper "On certain Branches of Industry in Ireland," with special reference to the steps taken by the Royal Dublin Society for their promotion.

MONDAY EVENING, FEBRUARY 17, 1868.

J. JOHNSTONE STONEY, A. M., F. R. S., in the Chair.

MR. GILBERT SANDERS read a paper "On the Construction of Meters for the Supply of Water for Domestic Use." Published.

DR. J. EMERSON REYNOLDS, Keeper of the Minerals, read a paper "On the Estimation of Phosphoric Acid in Minerals and Artificial Manures." Published.

After the paper had been read, the Chairman exhibited an Apparatus for illustrating Kundt's Experiments on Sound. This consisted of a long rod of steel, one end of which fitted with a cork into the end of a glass tube of about the same length, along the inside of which a little sand was scattered. On causing the steel rod to vibrate, the air in the tube also showed its vibrations by the sand being collected in little ridges at definite distances along the tube.

MONDAY EVENING, MARCH 16, 1868.

J. W. MAUNSELL, A. M., Secretary, in the Chair.

DR. STEELE read a paper "On the Colony of Natal," by Dr. Mann, F. R. G. S., and F. R. A. S., which was followed by a lengthened discussion, in which the Rev. M. SABON, a resident in the colony, DR. MORGAN, DR. BARRY, MR. MAC NEALE, DR. JACOB, and MR. ROPER each took a part.

MONDAY EVENING, MAY 4, 1868.

DR. BARKER, M. D., in the Chair.

DR. JAMES M. BARRY read a paper on the Physical Geography of the Southern Ocean.

DR. WALTER G. SMITH read a communication detailing the Analysis of a Specimen of Black Wax (published).

MONDAY EVENING, MAY 18, 1868.

DR. DE RICCI in the Chair.

DR. STEELE, in the absence of DR. MANN, F. G. S., read a communication by the latter, entitled "Notes on the Physical Geography, Geology, and Meteorology of the Colony of Natal" (published).

MR. W. ANDREWS, Chairman of the Natural History Committee, read a paper "On certain Woods and Timber Trees of New Zealand" (published).

PROFESSOR ROBERT S. BALL exhibited some experiments on the production of Smoke-wreaths. He made the following observations in connexion with them :—

The production of vortex-rings in air is experimentally shown by the interesting phenomena produced by Professor Tait. These are described by Sir William Thomson in the "Philosophical Magazine" for July, 1867. I repeated these experiments with the kind aid of Dr. Emerson Reynolds; in doing so an interesting variation of them presented itself which renders the air-rings actually visible.

While engaged on this subject, Mr. Yeates suggested to me to try the effect of discharging an air-ring at a column of smoke; this was done, and a most curious and unexpected appearance was the result. The box employed was a 2-feet cube, and had a hole 8 inches in diameter, the side opposite having a piece of stout sacking strained over it. A blow on the sacking causes an air-ring to dart from the hole. Two large flasks, containing respectively hydrochloric acid and ammonia were arranged with theirmouths in close proximity, and their contents vigorously boiled; from the union of their vapours a dense column of the fumes of chloride and ammonium ascended. This apparatus was placed about eight or ten feet in front of the box. An air-ring on first leaving the box was of course invisible; when it reached the column of smoke it could be seen to force its way through it; but when it left the column, and during its subsequent existence, its appearance was very remarkable. At first the idea suggested itself that the single air-ring had formed two concentric smoke-rings; but closer examination and an improved column of smoke showed what had really occurred. The air-ring had penetrated the smoke quite uninjured; it had not apparently left any of its particles behind, nor had it admitted an atom of smoke into it; but it had drawn with it sufficient of the smoke to form a complete shell, which enclosed it, and thus rendered the air visible. The phenomenon is quite in accordance with that conservative tendency which theory shows must belong to a vortex-filament. The appearance is one of great beauty, and suggested the name "negative smoke-ring."

Smoke-rings are seen to greatest perfection when directed along a sunbeam admitted into an otherwise darkened room; and though they can be seen beautifully in ordinary diffused sunlight, by gaslight they make a very poor show; special means of illumination are therefore necessary. The following arrangement is found to succeed admirably:—By a simple optical contrivance the radiation from a brilliant lime-light is concentrated into a slightly conical beam, all other light in the room being extinguished; the box is placed in the beam, the orifice facing the lamp, and from twenty to thirty feet distant from it; at the box the diameter of the circular section of the luminous cone is from three to four feet. A smoke-ring driven from the box will, if suitably directed, traverse the beam through its entire length until it reaches the lamp; and as it is brilliantly illuminated throughout its path, the appearance presented is of great beauty. A second box can be placed at the lamp end of the beam, so as to show the effect of the collision of rings. The fumes produced by burning a small piece of phosphorus developes an ample supply of smoke in the interior of the box. This mode of producing smoke was suggested to me by Dr. William Barker; it is simpler to manage inside the box than the apparatus necessary for forming chloride of ammonium. By the introduction of coloured glasses various pleasing effects can be produced. If a sheet of tissue-paper be very lightly attached to a frame, and interposed in the beam, a vigorously sent smoke-ring will sweep it away in a striking manner.

To exhibit the air-rings, the column of smoke already described is placed so as to ascend through the beam, and rather nearer the box than the lamp. An air-ring from the box is, of course, invisible till it reaches the column, while in its passage from the column to the lamp the curious phenomenon already mentioned is most beautifully shown. The negative smoke-rings are much better seen when thus illuminated than by ordinary daylight. A box of the dimensions previously given, viz. a 2-foot cube with a hole of 8 inches diameter, was found to answer better for this purpose than a somewhat smaller box, with a hole of 6 inches aperture.

The column of smoke may perhaps serve as a test for the existence of vortex-rings in other cases, when, produced in air, they are invisible. This was tried in one instance. It is a common trick to blow out a candle by the puff of air from the muzzle of a gun when the percussion cap is exploded on the nipple. This puff is probably a vortex-ring. Owing to the high velocity with which it moves, it is difficult to trace the effect produced by the column of smoke. One person, however, firing from an elevated position, and at a distance of 15 or 20 feet from the flasks down upon the column, and another watching against a dark background, a distinct ring was occasionally seen to dart from the column after the percussion of a cap; but whether these were "negative rings," as was expected, or ordinary "smoke rings," was not easy to determine.

AUGUST, 1867.

DATE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.	Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
		°		°	°	°	°	°	°	°				
1 Thursday, . . .														Observations suspended during the re-erection of the instrument house.
2 Friday, ...														
3 Saturday, . . .														
4 Sunday, . . .														
5 Monday, . . .														
6 Tuesday, . . .														
7 Wednesday, . .														
8 Thursday, . . .														
9 Friday, ...														
10 Saturday, . . .														
11 Sunday, . . .	30·100	69	30·067	73	54	51	55	57	73	66	S W.		. .	Fine and mild, overcast at times.
12 Monday, . . .	30·050	71	30·014	75	63	54	58	60	72	66	S. E		. .	Fine and mild, bright sunsh., strong wind.
13 Tuesday, . . .	29·910	73	29·869	75	60	51	59	61	74	69	S. E.		·060	Fine, very mild, bright sunshine, do.
14 Wednesday, . .	29·960	74	29·865	76	61	53	60	61	76	70	W.		. .	Fine, very mild, bright sunshine, little wind.
15 Thursday, . . .	29·650	64	29·631	74	59	48	58	61	75	68	W.		. .	Fine, very mild, very bright sun, do.
16 Friday, ...	29·700	60	29·692	70	56	49	57	60	62	57	W.		. .	Fine, brisk wind, overc. at times, strong wind.
17 Saturday, . .	29·600	65	29·581	68	55	50	56	59	65	60	W. by N.		·010	Mild, overcast, slight rain, little wind.
18 Sunday, . . .	30·050	62	30·014	66	50	47	55	58	65	59	S. W.		·130	Fine, mild, bright sun at times, overcast, do.
19 Monday, . . .	29·910	65	29·891	69	51	49	56	59	69	65	S. E.		·110	Fine, mild, overcast at times, slight sunshine.
20 Tuesday, . . .	29·540	60	29·532	62	54	50	57	60	61	60	S. E.		·025	Mild, overc., slight continued rain, sunshine.
21 Wednesday, . .	29·950	64	29·930	67	55	50	57	59	67	60	W.		·025	Very mild, overc., dull, clearing out to hot sun.
22 Thursday, . . .	29·942	66	29·916	68	55	50	57	59	64	59	W.		. .	Fine, mild, overcast, occasional sun.
23 Friday, ...	29·928	66	29·902	68	59	53	58	60	67	64	S. E.		·025	Very mild, dull, overcast, little wind.
24 Saturday, . . .	29·912	70	29·878	74	61	57	59	61	72	66	W. S. W.		. .	Fine, mild, overcast, bright sun, windy.
25 Sunday, . . .	29·824	67	29·799	75	61	60	60	62	70	64	W. S. W.		·040	Extremely mild, overc., rain, bright & fine.
26 Monday, . . .	29·928	65	29·906	73	51	48	58	61	68	59	N. W.		. .	Mild, windy, bright sun, cloudy.
27 Tuesday, . . .	30·000	61	29·989	59	45	43	55	58	62	56	W. N. W.		. .	Very fine, overcast, very fine, hot and windy.
28 Wednesday, . .	29·990	67	29·962	70	51	45	55	58	70	63	W. N. W.		·090	Overcast, rain, hot and windy throughout.
29 Thursday, . . .	30·050	62	29·935	64	53	50	56	59	63	61	S.		. .	Overcast, very mild and still throughout.
30 Friday, ...	29·810	66	29·759	66	60	55	58	60	66	60	S. W.		·170	Showery, overcast, windy.
31 Saturday, . . .	29·848	65	29·827	66	57	54	58	60	65	63	S. E.		·660	Heavy rain, overcast, windy, close and still.
													1·830	inches.

SEPTEMBER, 1867.

DATE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.	Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In earth. 5 in.	In earth. 10 in.	Dry.	Wet.	Direction.			
		°		°	°	°	°	°	°	°				
1 Sunday, ...	29·831	60	29 823	60	57	55	58	60	60	59	E. N. E.	0	·300	Dull, rain, soft wind, no sun, overcast.
2 Monday, ...	30·082	66	30·056	68	57	50	57	59	68	64	S. E.	0	·350	Fine, mild, soft wind, hot sun.
3 Tuesday, ...	29·892	65	29·873	70	56	51	59	61	68	65	S. E.	0	·230	Overcast, fine and mild, little wind, hot.
4 Wednesday, . . .	29·550	67	29·526	67	53	51	58	61	67	62	S. W.	0	. .	Fine, overcast, strong wind, fine day.
5 Thursday, ...	29·621	63	29·608	66	50	47	55	58	66	61	S. W.	0	·040	Fine, dry, boisterous wind, hot sun.
6 Friday, ...	29·467	62	29·454	66	51	47	55	58	65	59	S. W.	0	·070	Do. do. showery.
7 Saturday, ...	29·804	62	29·791	65	54	48	54	57	65	60	W. S W.	0	·060	Fine, overcast, dry, hot sun, windy.
8 Sunday, ...	29·712	60	29·704	60	49	46	54	57	60	57	S. E.	3	. .	Fine, overcast, drying wind, slight rain.
9 Monday, ...	29·782	61	29·722	64	52	48	54	56	63	59	S.	2	·015	Fine, mild, overcast, very calm.
10 Tuesday, ...	29·748	63	29·732	66	48	45	53	56	65	60	W.	5	·150	Fine, hot, overcast, showery.
11 Wednesday, . . .	29·778	62	29·765	65	46	44	53	56	65	61	S. W.	2	. .	Fine, overcast, very calm.
12 Thursday, ...	29·478	58	29·475	58	56	54	54	56	58	55	W.	1	·120	Rainy, very stormy, overcast.
13 Friday, ...	29·850	60	29·842	63	49	47	53	55	63	58	W.	2	. .	Fine, bright, overcast, oçcl. outbursts of sun.
14 Saturday, ...	29·740	61	29·730	62	52	47	53	55	62	58	S. W.	3	·050	Overcast dull, bright and hot at times.
15 Sunday, ...	30·110	62	30·095	64	48	46	52	55	54	60	N. W.	4	·040	Very fine, cold, bright and hot at times.
16 Monday, ...	30·316	59	30·309	63	47	45	52	55	62	58	N. W.	6	·020	Fine, bright, overcast, hot, strong breeze.
17 Tuesday, ...	30·428	55	30·431	60	38	33	49	53	60	56	E.	5	. .	Fine, very calm, bright sun.
18 Wednesday, . . .	30·450	61	30·437	65	46	43	50	53	64	60	E.	6	. .	Fine, bright, hot, fine breeze.
19 Thursday, ...	30·256	60	30·246	64	40	39	50	53	63	60	S. W.	5	. .	Very fine, bright, overcast, hot sun at times.
20 Friday, ...	30·256	60	30·246	62	48	39	51	54	62	58	N. E.	3	. .	Fine, overcast, hot sun at times.
21 Saturday, ...	30·000	58	29·996	62	43	39	50	54	61	58	N. W.	1	. .	Very fine, cold, bright, overcast.
22 Sunday, ...	29·928	59	30·021	62	51	48	52	54	61	57	W.	3	·100	Fine, bright, overcast, strong wind.
23 Monday, ...	29·876	59	29·771	62	52	49	53	55	61	56	N. W.	4	·050	Stormy, wet, strong wind.
24 Tuesday, ...	30·376	56	30·377	60	45	43	50	53	59	55	N. W.	5	. .	Fine, bright, cold, overcast at times.
25 Wednesday, . . .	30·444	54	30·449	56	43	38	49	52	56	53	W.	3	. .	Fine, bright, cold, overcast, dull.
26 Thursday, ...	30·358	58	30·354	62	47	43	50	52	61	58	S. W.	0	. .	Dull, overcast, cold.
27 Friday, ...	30·228	57	30·227	60	51	48	51	54	59	56	N. W.	1	. .	Fine, mild throughout, cloudy.
28 Saturday, ...	30·150	60	30·140	63	53	50	52	54	62	58	W.	2	. .	Fine, bright, hot sun at times.
29 Sunday, ...	30·150	58	30·146	60	50	52	53	55	59	55	S. W.	0	. .	Cloudy, strong wind.
30 Monday, ...	29·972	57	29·971	57	56	53	53	55	56	53	S. W.	0	. .	Fine, very strong wind.
												66	1·590 inches.	

OCTOBER, 1867.

DATE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN. IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.	Observed Height.	Therm.	Cor-rected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
		°		°	°	°	°	°	°	°				[day.
1 Tuesday, ...	30·424	54	30·431	56	39	36	49	52	56	53	S. W.	2	. .	Fine, bright, cold, hot at times during the
2 Wednesday, . .	29·850	54	29·858	56	49	47	49	52	55	52	N. W.	2	·035	Very stormy, boist., slt. rain, bt. at times.
3 Thursday, . . .	30·072	48	30·095	51	37	35	46	50	51	49	N. W.	3	. .	Fine, cold, stormy wind, bt. sun at times.
4 Friday, ...	30·300	44	30·338	49	27	33	48	47	45	43	N. W.	2	. .	Bright, very cold, overcast, showery.
5 Saturday, . . .	30·176	49	30·196	50	43	41	45	47	50	49	N. W.	1	·060	Dull, overc., shwy., occasional outb. of sun.
6 Sunday, ...	29·930	54	29·937	55	45	44	48	50	55	53	N. W.	0	·180	Densely overcast, with rain, fine, mild.
7 Monday, ...	29·678	51	29 694	52	46	45	48	50	51	47	N. W.	2	·220	Cloudy, showery, fine, bright.
8 Tuesday, ...	29·696	47	29·722	51	39	37	44	48	51	48	N. W.	1	·180	Cloudy, cold rain, bright and fine.
9 Wednesday, . .	29·616	50	29·634	53	38	37	44	47	58	52	W.	0	·420	Continued rain.
10 Thursday, . . .	30·022	57	30·021	60	38	36	47	49	59	55	N. E.	2	. .	Fine & mild, bright, hot sun throughout.
11 Friday, ...	30·120	55	30·124	58	44	41	48	50	57	56	W.	0	. .	Very mild, overcast.
12 Saturday, . . .	29·812	58	29·809	60	52	50	50	51	59	57	W.	0	. .	Misty, overcast, fine, very mild and calm.
13 Sunday, ...	29·502	54	29·510	55	52	48	51	53	54	50	S. E.	0	. .	Dull, overcast, very mild and calm.
14 Monday, ...	29·524	57	29·524	59	51	49	51	53	59	57	W.	0	·170	Overcast, rain, very mild.
15 Tuesday, . . .	29·690	51	29·706	53	43	41	49	52	58	52	N. W.	0	·030	Dull, very mild, slight rain.
16 Wednesday, . .	29·596	51	29·612	53	35	35	47	50	53	52	S.	0	·010	Fine, clear, frosty, damp & cold, slt. rain.
17 Thursday, . . .	29·444	54	29·453	55	44	45	49	50	54	53	S. W.	0	·290	Fine & mild, clear & bt., heavy show. rain.
18 Friday, ...	29·540	52	29·553	50	47	45	48	49	50	49	S. W.	0	·010	Fine, very mild, overcast at times.
19 Saturday, . . .	29·582	53	29·593	53	45	44	47	49	52	51	N. W.	3	·030	Fine, mild, showery, occasl. outbst. of sun.
20 Sunday, ...	29·882	52	29·895	55	42	40	47	49	55	52	S. W.	2	. .	Fine and mild, overcast occasionally.
21 Monday, ...	29·874	64	29·855	66	50	46	51	51	65	62	S. E.	3	·030	Fine very mild, showery & calm, brt. sun.
22 Tuesday, . . .	29·960	62	29·945	63	59	55	58	53	63	61	S.	1	. .	Fine, mild, overcast at times.
23 Wednesday, . .	29·836	60	29·828	64	54	49	53	53	63	59	S.	2	. .	Fine, very mild, outbursts of sun, overcast.
24 Thursday, . . .	29·932	53	29·944	55	49	47	50	53	54	53	N. E.	0	·190	Fine, mild, rainy, overcast.
25 Friday, ...	30·156	53	30·166	54	50	48	50	52	53	53	N. E.	0	·060	Very mild, overcast at times, and calm.
26 Saturday, . . .	29·944	52	29·956	53	42	40	48	51	52	52	S. W.	0	. .	Fine, mild, cloudy, very calm.
27 Sunday, ...	29·330	48	29·354	51	42	40	47	50	50	47	N. W.	1	·370	Very stormy, with heavy rain, bt. and fine.
28 Monday, ...	29 916	47	29·942	51	34	32	44	47	51	48	W.	3	·020	Fine, clear and frosty, bright throughout.
29 Tuesday, ...	29·660	53	29·671	54	47	43	47	48	53	52	S. W.	0	·130	Cloudy, very stormy, with heavy rain, mild.
30 Wednesday, . .	29·876	54	29·884	56	45	41	47	49	56	54	S. E.	3	·130	Dull, bright and fine, overcast.
31 Thursday, . . .	29·776	55	29·781	56	47	45	48	50	56	54	S. W.	1	·020	Foggy, very mild and fine, overcast.
												32	2·625 inches.	

NOVEMBER, 1867.

DATE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.	Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
		°		°	°	°	°	°	°	°				
1 Friday, ...	30·016	47	30·042	51	44	41	46	49	49	45	N. W.	2	·110	Dull & foggy, fine & mild, overcast, rain.
2 Saturday, ...	30·470	50	30·486	54	35	33	44	47	54	52	S. W.	3	. .	Clear and frosty, fine and bright sun.
3 Sunday, ...	30·402	47	30·428	50	30	29	42	44	49	46	N. W.	2	.	Clear & frosty, bt. & sunny, slightly overc.
4 Monday, ...	30·318	52	30·330	53	45	42	44	45	52	51	N. W.	1	·010	Cloudy & dull, bt. & sunny, overc. & cold.
5 Tuesday, ...	30·300	47	30·326	50	40	36	45	46	50	49	S.	0	. .	Bright and mild, dull and overcast, no sun.
6 Wednesday, . . .	30·384	44	30·417	52	33	33	43	45	51	49	S.	2	. .	Clear and cold, foggy, bright and sunny.
7 Thursday, ...	30·480	47	30·505	50	31	23	41	43	49	46	S. W.	2	. .	Foggy and frosty, cold and bright.
8 Friday, ...	30·562	50	30·578	52	45	42	43	45	52	51	W.	1	. .	Fine and mild, and calm.
9 Saturday, . . .	30·562	46	30·589	54	29	29	41	44	54	53	S. E.	2	. .	Fine, clear and frosty, bright and sunny.
10 Sunday, ...	30·456	42	30·494	45	33	32	40	43	45	44	W.	0	·030	Intensely foggy, cold, calm, bright & fine.
11 Monday, ...	30·258	45	30·289	50	38	34	42	44	50	48	S. E.	2	. .	Bright, fine and mild throughout.
12 Tuesday, ...	30·108	44	30·141	47	36	35	42	43	46	46	S.	0	. .	Bright and fine, very foggy and calm.
13 Wednesday, . . .	29·776	49	29·797	52	43	41	43	44	52	50	S.	1	. .	Dull, very mild, foggy, bright and sunny.
14 Thursday, ...	29·404	50	29·423	52	48	44	44	45	52	52	E.	0	·240	Rainy, overcast, and very mild.
15 Friday, ...	29·644	48	29·667	52	42	40	45	46	51	50	E.	0	·040	Rainy and dark, mild and fine.
16 Saturday, ...	29·904	45	29·936	46	45	41	44	46	46	43	N. E.	0	. .	Very stormy, fine & clear, stmy. boist. wind.
17 Sunday, ...	30·156	40	30·195	47	46	38	42	44	46	45	E.	0	·080	Stormy, wet, very cold.
18 Monday, ...	30·336	42	30·375	45	32	30	40	43	45	45	N. W.	1	. .	Clear & frosty, fine & bright, overcast, calm.
19 Tuesday, ...	30·398	48	30·421	50	44	40	43	44	50	48	N. W.	2	. .	Dull and mild, fine, sunny.
20 Wednesday, . . .	30·580	40	30·574	43	34	32	40	43	43	43	N. W.	2	. .	Clear and frosty, cold, bright sun.
21 Thursday, ...	30·590	41	30·631	44	39	36	40	42	44	43	N.	0	. .	Dull & cold, fine and calm, no sun, cloudy.
22 Friday, ...	30·564	42	30·602	44	37	34	39	41	44	43	N. W.	0	. .	Very cold and dull, no snn.
23 Saturday, ...	30·506	43	30·442	46	40	37	40	42	46	45	W.	0	. .	Dark and cold, cloudy, fine, little sun.
24 Sunday, ...	30·526	42	30·564	43	40	37	40	42	43	43	N. W.	0	. .	Dark, foggy, and cold, no sun, calm.
25 Monday, ...	30·380	44	30·413	48	41	39	41	43	47	45	S. W.	0	. .	Very foggy, dark, and mild, fine.
26 Tuesday, ...	30·066	47	30·092	49	44	41	42	43	49	48	N. W.	0	. .	Dull, mild, overcast, fine, rain.
27 Wednesday, . . .	30·256	32	30·332	40	29	27	39	42	40	40	N. W.	4	·020	Rain, clear and frosty, fine bright sunshine.
28 Thursday, . . .	30·278	35	30·336	48	26	25	36	39	42	39	W.	3	. .	Clear and frosty, fine, bright sunshine.
29 Friday, ...	30·149	36	30·204	48	28	23	35	38	43	43	N. W.	2	. .	Clear and frosty, fine bright sun, foggy.
30 Saturday, ...	29·500	50	29·518	52	42	38	39	40	52	51	W.	0	·040	Cloudy and damp, mild and stormy, wind.
												32	·570 inches.	

DECEMBER, 1867.

DATE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.	Observed Height.	Therm.	Cor-rected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
		°		°	°	°	°	°	°	°				
1 Sunday, ...	29·158	49	29·180	50	48	46	44	44	50	49	N. W.	0	·630	Very mild, heavy rain, fine, cloudy.
2 Monday, ...	29·868	32	29·984	38	29	28	36	39	33	32	N. W.	1	. .	Clear, intens. cold wind, frosty throughout.
3 Tuesday, ...	30·288	34	30·348	37	27	25	34	38	37	35	N. W.	1	. .	Clear, bt., frosty, cold wind, fine & sunny.
4 Wednesday, . . .	30·180	37	30·282	42	32	28	34	37	42	38	S. W.	2	. .	Dull & cloudy, clear & frosty, mild & sunny.
5 Thursday, . . .	29·820	38	29·678	40	33	31	35	37	40	38	N. W.	2	·040	Dull & cloudy, frosty & cold, bt. sunshine.
6 Friday, ...	30·180	35	30·188	40	32	30	34	37	39	37	N. W.	3	. .	Bright and cold, windy, frosty, fine and bt.
7 Saturday, . . .	30·392	33	30·455	39	27	26	33	36	38	37	N.	3	. .	Cloudy, frosty, clear, bright sunshine.
8 Sunday, ...	30·142	37	30·194	40	32	29	33	35	40	38	N. W.	0	·040	Cloudy, frosty, cold rain.
9 Monday, ...	30·204	42	30·241	43	39	36	37	38	43	43	W.	0	·090	Dull, overcast, rain.
10 Tuesday, ...	30·118	48	30·245	49	43	41	40	40	48	48	N. W.	0	. .	Dull, cloudy, mild,
11 Wednesday, . . .	30·176	48	30·199	49	45	43	42	42	48	48	N. W.	0	. .	Very mild, with heavy clouds, no sun.
12 Thursday, . . .	30·250	48	30·273	50	47	44	43	43	50	48	W.	2	. .	Very mild, cloudy, bright sun.
13 Friday, ...	30·228	44	30·261	47	39	37	41	42	47	45	W.	0	. .	Very mild, bright and fine throughout.
14 Saturday, . . .	29·784	50	29·802	52	45	42	43	43	52	51	S. W.	0	·030	Very mild, cloudy & dark, bt., stormy, rain.
15 Sunday, ...	29·712	52	29·725	54	48	45	45	45	53	53	W.	0	·180	Very stormy, with rain.
16 Monday, ...	29·668	52	29·681	53	52	49	46	46	53	52	W.	0	. .	Extremely mild, rain, fine, stormy wind.
17 Tuesday, ...	29·526	44	29·560	45	43	40	44	46	45	43	W.	2	·060	Very mild, cloudy, slight rain, bright sun.
18 Wednesday, . .	29·544	36	29·599	38	33	31	39	42	38	37	N. W.	1	. .	Bright, cold, snow and frosty, cold wind.
19 Thursday, . . .	29·788	34	29·848	36	30	29	36	39	36	36	W.	1	. .	Bright, cold, and frosty throughout.
20 Friday, ...	29·794	39	29·842	41	35	34	37	39	41	41	E.	0	·050	Dull and misty rain throughout.
21 Saturday, . . .	29·684	52	29·697	53	41	39	43	43	53	51	S. W.	2	·040	Cloudy, rain, fine, bright, very mild.
22 Sunday, ...	29·920	45	29·952	46	40	38	42	44	46	44	S. W.	3	·060	Very bt. and mild throughout, slight rain.
23 Monday, ...	29·844	44	29·878	47	32	31	40	42	47	46	S. E.	0	·120	Bright and cold, stormy, rain, very mild.
24 Tuesday, . . .	29·828	50	29·846	51	46	41	43	44	51	50	S. W.	0	·030	Dark and cloudy, rain, very mild.
25 Wednesday, . . .	30·156	32	30·222	36	31	31	39	42	36	35	N. W.	2	·040	Dull, rain, bright and frosty, sunshine.
26 Thursday, . . .	30·172	41	30·214	47	34	33	39	41	46	45	S. E.	2	. .	Foggy, clear and bright, mild and fine.
27 Friday, ...	30·172	40	30·314	42	39	35	39	40	42	42	N. W.	0	. .	Foggy and mild, cloudy, occasional sunsh.
28 Saturday, . . .	30·228	42	30·267	44	40	38	39	41	44	43	S. E.	0	. .	Dull and cloudy, mild and still throughout.
29 Sunday, ...	30·100	44	30·138	46	40	38	40	42	46	44	E.	2	. .	Dark and cloudy, mild, fine and brt. sunsh.
30 Monday, ...	30·300	40	30·344	42	39	36	39	41	42	40	E.	2	. .	Overc. & cl., slt. rain, brt. & fine, cold wind.
31 Tuesday, ...	30·238	37	30·290	39	35	32	38	40	39	38	S. E.	1	. .	Cold and dull, bright and fine.
												32	1.410 inches.	

JANUARY, 1868.

DATE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.	Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
		°		°	°	°	°	°	°	°				
1 Wednesday, . . .	30·110	35	30·168	35	29	28	35	37	35	35	N. W.	0	. .	Very cold & frosty, densely overc. throughout.
2 Thursday, ...	30·208	36	30·263	36	34	30	35	37	36	35	E.	0	. .	Overcast, cloudy and dark, fine, cold wind.
3 Friday	30·238	36	30·293	37	28	27	34	36	37	36	E.	3	. .	Cloudy, very cold, bt. & frosty, sn., bt., & f.
4 Saturday, ...	30·062	32	30·128	34	24	25	32	35	34	33	N. W.	0	. .	Cloudy, bright, clear, and frosty, sn. at int.
5 Sunday, ...	30·028	40	30·072	41	34	31	35	36	41	40	S. E.	0	·090	Cloudy, cold, rain, fine, cold wind.
6 Monday, . . .	30·040	40	30·084	41	38	34	36	37	41	40	N. E.	0	·030	Cloudy, cold, rain, fine and mild, cloudy.
7 Tuesday, ...	30·020	39	30·067	40	39	36	36	38	40	39	E.	0	·030	Cloudy, rain at times, fine, but cold & cloudy.
8 Wednesday, . . .	30·088	34	30·128	36	30	28	34	37	36	36	N. W.	0	. .	Cloudy, bt. and frosty, cl. and overc., damp.
9 Thursday, ...	30·050	38	30·099	38	36	34	35	37	38	37	S.	0	. .	Cloudy, cold throughout.
10 Friday, ...	29·908	39	29·956	39	38	35	36	38	39	39	S. E.	0	·050	Cloudy, very cold, boister. wind and rain.
11 Saturday, ...	29·624	47	29·650	50	38	36	39	39	50	48	N. W.	0	·730	Cloudy, with cont. rain, and stormy wind.
12 Sunday,.	29·624	48	29·647	50	43	39	41	41	50	49	W.	0	·050	Cloudy, bright and fine, rain, fine, but cl.
13 Monday, ...	29·254	40	29·299	40	36	34	39	40	40	39	N. W.	0	·220	Fine and bright, cloudy, rain, very stormy.
14 Tuesday, ...	29·200	55	29·207	55	40	37	43	43	55	54	W.	0	·050	Cloudy, fine and bright, very stormy, with r.
15 Wednesday, . . .	29·824	45	29·856	45	40	38	40	42	45	42	W.	1	·160	Very stormy, fine, cloudy, with r., fine & bt.
16 Thursday, ...	29·708	54	29·716	55	41	38	42	42	55	53	S. W.	0	. .	Clear & bt., cloudy, fine & mild, st. wind.
17 Friday, ...	29·472	47	29·498	47	42	42	43	44	47	47	S. W.	0	·130	Very mild, cloudy, stormy, with rain.
18 Saturday, ...	28·614	48	28·639	48	41	39	42	43	48	46	W.	0	·130	Fine and cloudy, stormy wind & r., very st.
19 Sunday, ...	28·934	44	28·969	45	40	38	40	42	45	44	N. W.	1	·040	Very stormy, with cold rain, brt. and fine.
20 Monday, ...	29·200	40	29·245	42	36	33	39	41	42	41	E.	0	·230	Fine, but cold, foggy, mild rain.
21 Tuesday, ...	29·562	38	29·612	43	34	32	39	41	43	40	N. W.	3	·020	Cloudy and thick, with r., frosty, bt. & fine.
22 Wednesday, . . .	29·190	40	29·235	41	39	35	38	40	41	40	N. E.	0	. .	Fine, cold and stormy, cloudy.
23 Thursday, ...	29·858	40	29·903	45	34	30	37	39	45	42	S. E.	3	·020	Cloudy, bt. and frosty, overc., bt. and fine.
24 Friday, ...	29·560	46	29·589	49	35	30	38	39	49	47	S. W.	2	. .	Fine, cold and cloudy, frosty, fine, very st.
25 Saturday, ...	29·572	42	29·611	43	41	38	38	40	43	42	W.	1	·280	Fine and mild, cloudy, r., fine and bt., overc.
26 Sunday, ...	30·236	41	30·278	45	35	32	38	40	45	43	N. W.	3	. .	Fine and bt., frosty, cold wind, bt. sunshine.
27 Monday, ...	30·070	50	30·087	51	40	37	41	41	51	50	W.	0	·080	Fine and bt., cloudy, r., fine and m., overc.
28 Tuesday, ...	29·964	49	29·984	50	48	46	43	43	50	49	W.	0	. .	Fine and mild, overc. and cloudy, very md.
29 Wednesday, . . .	30·264	40	30·308	44	34	32	39	41	44	42	N. W.	3	. .	Fine, cold, and frosty, fine and bt. sunshine.
30 Thursday, ...	29·926	49	29·946	51	40	37	40	41	51	49	S. W.	0	. .	Fine and sunny, bt. and frosty, cl., f., & m.
31 Friday, ...	29·556	54	29·564	56	50	47	44	44	56	53	W.	3	. .	Fine and mild, cloudy, bt. sun, and boister.
												23	2·340	Inches.

FEBRUARY, 1868.

DATE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
							In Earth.							
Day, At 12 o'Clock, P. M.	Observed Height.	Therm.	Cor-rected.	Max.	Min.	On Grass.	5 in.	10 in.	Dry.	Wet.	Direction.			
		°		°	°	°	°	°	°	°				
1 Saturday, . . .	29·228	49	29·250	50	44	40	44	45	50	46	N. W.	3	·250	Fine, boists. wind, with rain, bright and fine.
2 Sunday.	29·736	40	29·781	43	36	34	39	42	43	41	N. W.	0	·020	Fine, boist. wind, with r., fine, but par. overc.
3 Monday, ...	29·848	38	29·898	40	34	31	38	41	40	38	N. W.	2	·150	Fine, but cold rain, frosty, bright sunshine.
4 Tuesday, . . .	30·136	46	30·164	48	34	31	38	39	48	46	N. W.	0	·020	Fine and clear, frosty, mild and fine, slight r.
5 Wednesday, . .	29·876	49	29·897	50	44	40	41	41	50	48	S. W.	0	·150	Fine and mild, boist. wind, with rain, fine, cl.
6 Thursday, . . .	30·224	44	30·257	48	38	35	40	42	48	46	W.	3	·020	Fine, boist., *aur. bo.* vis., r., fine bt. suns., m.
7 Friday, ...	29·626	49	29·647	50	40	37	41	42	50	48	S. W.	3	. .	Very mild & fine, stor., fine & mild, bt. sunsh.
8 Saturday, . . .	30·010	40	30·054	43	33	31	39	41	43	41	N. E.	3	·100	Showery, fine and bright, frosty, bt. sunshine.
9 Sunday, ...	30·362	42	30·401	45	30	28	37	39	45	42	S. W.	1	. .	Cold, clear & frosty, cl., bt. & fine, brisk wd.
10 Monday, ...	30·366	49	30·386	50	44	42	42	42	50	48	N. W.	0	. .	Brisk wind and fine, cldy., occas. outb. of sun.
11 Tuesday, ...	30·542	48	30·564	49	44	40	42	44	49	46	N. W.	3	. .	Cloudy, mild and fine, bt. sunsh., brisk wind.
12 Wednesday, . .	30·424	45	30·455	49	34	32	40	42	49	46	W.	3	. .	Fine and clear, with bt. sunsh. throughout.
13 Thursday, . . .	30·162	47	30·188	49	41	37	41	42	49	47	S. W.	0	. .	Fine and mild, cloudy, fine, with brisk wind.
14 Friday, ...	29·892	50	29·910	50	45	42	42	43	50	48	S. W.	0	. .	Fine and dry, brisk wind, cloudy.
15 Saturday, . . .	30·128	42	30·167	44	38	34	41	43	44	41	N. W.	2	·060	Fine, cloudy, rain, fine and bt., brisk wind.
16 Sunday, ...	30·270	43	30·306	46	34	31	38	41	46	43	S. W.	0	·010	Cold and stormy, frosty, fine, but cold, bois. w.
17 Monday, ...	30·124	46	30·152	49	43	40	41	42	49	46	N. W.	2	·040	Cold wind, dk. and cldy., r., bt. and fine, suns.
18 Tuesday, ...	29·874	45	29·906	48	38	33	40	41	48	45	S. W.	0	. .	Cloudy and cold, partially overc., brisk wind.
19 Wednesday, . .	29·976	42	30·015	44	38	34	39	41	44	43	N. E.	2	·270	Cold and cloudy, stormy, with r., bt. and fine.
20 Thursday, . . .	29·668	47	29·694	49	31	29	39	40	49	47	S. W.	0	·030	Cold wind, frosty, overc., rain, and very stor.
21 Friday, ...	29·854	50	29·872	52	42	39	42	43	52	50	S. W.	2	·130	Boist. wind and rain, fine and mild, bt. sun.
22 Saturday, . . .	29·630	42	29·669	46	38	35	40	42	46	43	W.	1	·090	Cold and boists., wind and rain, bt. and fine.
23 Sunday, ...	30·242	47	30·268	49	35	32	39	41	49	47	S. W.	0	. .	Overcast, boisterous wind, fine and bright.
24 Monday, ...	30·134	52	30·146	54	47	44	43	43	54	52	W.	0	. .	Fine and mild, cldy., with slight r., very mild.
25 Tuesday, . . .	30 828	55	30·332	58	49	45	45	45	58	55	S. W.	2	. .	Very mild and fine, brisk wind, bt. sunshine.
26 Wednesday, . .	30·152	52	30·164	54	48	45	45	46	54	51	W.	1	. .	Extmly. mild and fine, brisk wind, par. overc.
27 Thursday, . . .	29·842	50	29·860	52	49	45	45	46	52	50	S. W.	0	. .	Fine and mild, part. overc. at times, bk. wind.
28 Friday, ...	29·542	50	29·560	50	48	44	45	46	50	48	S. W.	0	·150	Fine and mild, cloudy, rain. [and showery.
29 Saturday, . . .	29 284	45	29·317	42	40	35	42	44	42	41	W.	0	·120	Showery, cloudy, clear and frosty, fine, cold,
												33	1·510	inches.

MARCH, 1868.

DATE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day. At 12 o'Clock, P.M.	Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in	Dry.	Wet.	Direction.			
1 Sunday, ...	29·816	42°	29·855	44°	34°	29°	39°	42°	44°	42°	W.	0	·040	Cold, sleety rain, cloudy, fine and clear, fros., [brisk wind.
2 Monday, ...	30·050	51	30·065	52	43	39	43	44	52	50	W.	1	·100	Showery and cold, fine and mild, cloudy.
3 Tuesday, ...	30·130	52	30·142	53	49	45	45	45	53	52	W.	0	·040	Very mild, dark and cloudy, slight rain.
4 Wednesday, . . .	29·860	55	29·865	58	45	42	45	46	58	53	W.	2	. .	Cloudy, very mild and fine, bt. suns., bol. w.
5 Thursday, . . .	29·630	47	29·656	48	45	41	45	46	48	46	N. W.	1	·520	Boist. wind, heavy rain, cloudy, inter. suns.
6 Friday, ...	29·760	46	29·789	48	37	34	41	44	48	44	N. W.	1	·020	Boist. wind, cloudy, showery, bt. and fine.
7 Saturday, ...	29·500	46	29·529	48	40	37	41	43	48	47	S. W.	0	·030	Fine and mild, overcast at times, showery.
8 Sunday, ...	29·276	40	29·321	43	32	30	39	42	43	40	N. W.	1	·100	Showery, fine and bt., cold and st., with sn.
9 Monday, ...	29·210	44	29·245	44	34	31	38	40	44	43	S. E.	0	. .	Boisterous wind, clear and frosty, overcast.
10 Tuesday, ...	29·338	49	29 360	51	40	36	40	42	51	48	S. W.	2	·020	Overc., cold rain, fine and mild, bright sun.
11 Wednesday, . .	28·796	50	28·816	53	44	39	42	43	53	50	S.	0	·070	Bt. and fine, stormy, overc., shwy., m. and f.
12 Thursday, . . .	29·470	50	29·488	52	40	36	41	43	52	48	S. W.	0	. .	Cloudy, fine, showery, cold, occasional sun.
13 Friday, ...	29·720	55	29·725	56	49	45	45	45	56	53	S. W.	0	. .	Cloudy, boisterous wind, very mild and dry.
14 Saturday, . . .	29·968	50	29·985	53	42	38	44	45	53	47	S. W.	2	·020	Cloudy, very st. wd., sl. r., fine and bt. sun.
15 Sunday, ...	29·850	50	29 868	54	40	39	44	45	54	52	S. W.	0	. .	Cloudy, brisk wind, occasional sunshine.
16 Monday, ...	29·722	55	29·727	57	47	35	46	46	57	54	S. W.	0	. .	Overc., fine & drying w., very m. throughout.
17 Tuesday, ...	29·930	44	29·963	43	37	34	42	45	43	42	N. W.	0	·110	Cloudy, showery, very cold, occasional sun.
18 Wednesday, . .	30·184	48	30·207	50	33	30	40	43	50	47	S. W.	1	·060	Cloudy, overc., shwy., f. and bt., fr., bk. w.
19 Thursday, . . .	29·846	45	29·878	48	37	34	41	43	48	44	N. W.	1	·040	Cd., c. wd., showery, frosty, f., but cld. wd.
20 Friday, . . .	29·810	50	29·828	52	44	40	43	44	52	50	N. W.	0	·010	Overcast, cloudy, mild, and damp.
21 Saturday, . . .	29·964	52	29·976	54	47	46	44	45	54	52	S. W.	0	. .	Cloudy and dark, cold wind, fine and mild.
22 Sunday, ...	29·730	52	29·743	53	49	45	45	46	53	50	N. W.	0	·020	Cly., very fine & mild throughout, showery.
23 Monday, ...	29·816	40	29·861	52	37	33	40	48	52	40	N. W.	0	·290	Cold, heavy showers rain and sleet through.
24 Tuesday, ...	29·992	40	30·036	42	32	31	39	42	42	40	W.	0	. .	Cloudy, cold, frosty, fine, partially overcast.
25 Wednesday, . . .	29·962	44	29·995	48	38	35	40	42	48	46	S. W.	0	·090	Fine, but very cold, with sl., ml., cl., and sh.
26 Thursday, . . .	30·016	53	30·026	56	47	44	45	45	56	53	N. W.	0	·050	Showery, fine and mild, overcast.
27 Friday, ...	30·278	54	30·285	57	48	40	45	46	57	54	N. W.	2	. .	Fine and mild throughout, bright sunshine.
28 Saturday, ...	30·500	52	30·511	55	45	40	46	47	55	53	E.	0	. .	Fine & mild, calm, frosty air, fine & very md.
29 Sunday, ...	30·494	49	30 513	55	38	36	46	47	55	52	E.	5	. .	Very fine, bt. sunsh. throughout, very calm.
30 Monday, ...	30·474	55	30·477	57	39	37	45	47	57	53	N. W.	6	. .	Bt. sunsh., heavy fog, frosty air, bt. sunsh.
31 Tuesday, ...	30·410	55	30·414	59	45	41	46	48	59	55	N. W.	7	. .	Very bright and fine throughout, brisk wind.
												34	·630	Inches.

No. XXXVIII.] [Price 2s.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

CONTENTS.

PAGE.
1. Dr. Barry on the Physical Geography of the South Atlantic, ... 277
2. Mr. Alloway on Peat, and its profitable Utilization, ... 281
3. Rev. J. A. Galbraith on the Metric System of Weights and Measures, . . . 291
4. Dr. Mapother on the Wonders of the Blood, and its Circulation, ... 300
5. Mr. Stoney on Meteoric Showers, ... 307
6. Dr. Wyville Thomson on the Depths of the Sea, ... 316
7. Dr. Macalister on the Law of Symmetry in Animal Forms, ... 327
8. Mr. Ball on Nebulæ, ... 339
9. Mr. Baruchson on Beet-Root Sugar Manufacture in Ireland, ... 348
10. Mr. Kirby on the Ailanthus-feeding Silk-worm, and the probability of its easy Naturalization in Ireland, ... 366
11. Dr. Reynolds on a New Product of the Action of Heat on Sulphocyanate of Ammonium, ... 370
12. Dr. Moore on growing Kohl-Rabi among Mangold-Wurtzel, ... 373
13. Dr. Reynolds on Soluble and Insoluble Phosphates in Superphosphate of Lime and other Phosphatic Manures, ... 376
14. Mr. Andrews on the Ichthyology of the South-west Coast of Ireland, &c., . 379
15. Mr. More on Zoological Collections made in Kerry, ... 389
16. Return of Donations to the Royal Dublin Society, ... 395
17. Intelligence:—
    - Evening Meetings, ... 407
    - School of Art, ... 410
    - Annual Spring Cattle Show, ... 424

Appendix—Meteorological Journal from April, 1868, to January, 1869, . . xxxiii

DUBLIN:
HODGES, FOSTER, AND CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.
1869.

M. H. Gill, Printer to the Royal Dublin Society.

AUG 2 1917
LIBRARY

The Society

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

The Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Treasurer:—

Life Membership, ...	£21 0 0
Annual Membership (with £3 3s. Entrance Fee),	2 2 0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15s., £10 10s., or £5 5s., according to standing.

I.—MEETINGS OF THE SOCIETY AND THE COUNCIL.

1. *Stated and Ordinary Meetings.*

The Society meets at 3 o'Clock P. M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday of November.

The Council meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

2. *Evening Scientific Meetings.*

Meetings of the Society, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5s. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6*d*. each; or to twelve for 5s., available for any of the ordinary Meetings throughout the Session.

THE STANDING COMMITTEES.

Six Standing Committees are annually elected, as follows:—1. Agriculture; 2. Botany; 3. Fine Arts; 4. Library; 5. Natural History; 6. Practical Science.

[*For continuation, see page* 3 *of Cover.*

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

XXV. — *Notes on the Physical Geography of the South Atlantic.*

By Dr. J. M. Barry.

[Read May 4, 1868.]

The atmosphere resting on the ocean is divided into regions defined by prevailing winds and calms: thus between the trade winds the equatorial calms prevail; on the polar side of the north-east trade are the calms of Cancer. Vessels trading between Europe and America with horses frequently fell short of water in these calms, and the horses died in great numbers—hence the popular name of "horse latitudes." Further north, we meet the counter trade of the Atlantic, blowing from the south-west towards the North Pole, in the vicinity of which calms again prevail. In the Southern Hemisphere the south-east wind blows towards the equatorial calms. On the polar edge of the south-east trade is the calm Belt of Capricorn, corresponding with that of Cancer in the Northern Hemisphere; further south we meet the counter trade wind of the Southern Hemisphere; lastly, the South Polar calms. Air has the same tendency to equilibrium as fluids, and heated air being light, and cold, heavy, the difference of temperature between the Tropical and Arctic regions produces two opposite currents—one from the heated region, the other towards it—the light warm air ascending at the equator towards the Poles in the form of an upper current, while the cold heavier air travels near the surface towards the equator in consequence of the diurnal rotation of the earth from west to east, and, the velocity being less in higher latitudes than in lower, the streams of air are deflected, becoming a north-east wind in the northern, and a south-east wind in the Southern Hemisphere being rarified near the equator. These aerial currents flow upwards, destroy each other, and produce the belt of equatorial calms, a gloomy region of rain, squalls, thunder, and lightning.

On the diagram the equatorial limits of these calms and winds at different seasons of the year are delineated. The sunswing from north to south carries the equatorial edge of north-east intertropical wind of the North Atlantic to the south, and the south-east wind of the South Atlantic follows the sun across the equator into the north. The equatorial termination of the north-east trade varies between the parallels of 17° north and 4° south, its mean limit is always north of the equator, except during the three first months of the year, when it may occasionally be carried to 4° south lat. To the westward of longitude 27° the mean position of the equatorial calm belt is about 5° north. In the earlier part of the year the southern edge of the calms is in the South Atlantic about the parallel of 2° south latitude.

In the diagram marked No. 1, the distribution of the winds in July and September is exhibited when the south-east trade attains its greatest northern declination, and the south-west monsoon, a wind now well recognized, blows between the trades. The south-east wind at this season of the year pushes its way to nearly 10° north. In No. 2 the south-east trade is represented as returning south between October and December, while No. 3 shows the position of these winds at the time of their greatest southern declination, between January and March. The south-west monsoon has entirely disappeared, and the equatorial limits of the north-east and south-east trades closely approximate. The region of calms between the trades is one of the most oppressive and disagreeable places possible to conceive: emigrant ships bound to Australia are often baffled in it for weeks, and the mortality among children and delicate persons is considerable—it is, indeed, as Maury observes, "a frightful graveyard on the highway to that golden land." The atmosphere, close and dense, produces a degree of lassitude and sleepy sluggishness most difficult to shake off. The belt of calms is narrower west of the meridian of 25°, and this may be adduced as a strong reason for vessels bound north or south crossing the equator between 25° and 30° west longitude.

The south-east trade wind blows with great regularity in the middle region of the South Atlantic; it extends from near the Cape of Good Hope. The homeward bound route from the Cape is in the middle of this vein. The homeward bounder from India uses this atmospheric stream, as the European-bound American does the Gulf Stream; it occupies a space about 20° broad. The region of calms, variable winds, and changeable weather on the southern edge of the south-east trade is succeeded still further south by the regular north-west winds of the Southern Ocean. The force and regularity of these winds in the Southern Hemisphere have led to their being called counter trade winds.

The Australian-bound ship runs her easting down to the southward of 40° before those brave west winds; the waves run high, the winds howl, and the sea roars. A ship driven by these strong winds accomplishes an amount of distance far beyond what steam power can attain to.

The atmosphere in the Southern Hemisphere is much more humid than in the Northern, the aerial circulation is more regular, the winds stronger and steadier. The number of gales with rain in the Southern Hemisphere are much in excess of those in the Northern, while calms and fogs are more frequent in the North Atlantic. Of 1228 gales observed in the Southern Ocean, 1195 were accompanied with rain; the waste waters are collected into Antarctic icebergs, and borne away to genial climes; the latent heat of fluidity which they dispersed in the Frigid Zone is restored as they approach the Torrid; resolved again into water, they cool the intertropical winds, help to mitigate climates, and moderate the gales, tempering the atmosphere to the wants of animal and vegetable life.

The ocean currents of the Southern Hemisphere are in some respects remarkable:—The great equatorial current, first perceivable in about 5° 30′ east longitude, 1° 30′ south latitude, it flows to the westward, attaining a speed of 15 to 25 miles per day, sends off a branch to the north-west near the meridian of 20°. This branch is traceable as far as 25° north latitude. The main stream in its westerly progress becomes wider before it reaches Cape Roque, not far from which it bifurcates—one branch flowing to the west-north-west, while the other turns to the southward, and forms the Brazilian current; as it proceeds to the southward, it spreads out, and is feebly felt as far as the Straits of Magellan. Another and stronger branch takes a south-easterly direction, and is called the connecting current. An eddy is formed in the centre of the South Atlantic by these currents, in which a quantity of weed and drift wood is to be found. Inside the Brazilian current there are counter streams, which run to the north from March to September, and to the southward the rest of the year. They are much affected by local influences. Off Cape Horn an easterly current is very constantly to be met with, having a velocity of about a mile an hour; it pursues a steady course across the ocean between Cape Horn and the Cape of Good Hope, and is, no doubt, the cause of an occasional accumulation of icebergs in west longitude south of the parallel of 40°, which I have alluded to in a former paper read before this Society.

There is a current of considerable importance in the vicinity of the Cape of Good Hope—it is in fact the overflow of the Indian Ocean rushing through the Mozambique Channel; it is joined south of Natal by another ocean river; the united waters pursue a course to the south-west, reaching the Agullus bank; it divides into two branches—one, recurving to the westward, mingles with the cold waters of the Antarctic drift; the other proceeds to the westward, and finally joins the Atlantic equatorial current, which I first alluded to. The Agullus current varies considerably in velocity: when I came round the Cape last year it was scarcely perceptible; while I find, from various sources of information, that it has been known to run from 70 to 100 miles per day. Running against a north-west gale, it produces the tremendous seas sometimes to be met with off the Cape of Good Hope. The warm waters of the Indian Ocean coming in contact with the colder waters of the South Atlantic, gives rise to one of the most formidable storm regions in the world. It will be perceived that these currents are in connexion, and produce important physical results; in their centre is a kind of Saragossa sea, and about the edges discoloured water is frequently seen.

In the higher latitudes of the Southern Ocean the range of the barometer is considerable (from two to three inches), while within the Tropics it is trifling, owing to the equable force with which the wind blows from the same quarter. On the approach of hurricanes, however, it sometimes falls two inches. The slightest deviation from the barometric mean of Tropical seas should be looked on by the mariner as a warning requiring prompt attention. It must be, however, remembered that there is a daily rise and fall of the mercury twice in the twenty-four hours. This regular alternation of the instrument is very remarkable, and any deviation from it foretells bad weather. The mean height of the barometer in the calm belts of Cancer and Capricorn is greater than in any other latitude: its mean is less in the equatorial calms than in the region of the trades. About 5° N. in the Atlantic the pressure of the atmosphere is so uniform as to afford an opportunity for comparing instruments by a natural standard.

There are two points in the Southern Hemisphere—Cape Horn and the Cape of Good Hope—which claim particular attention in a barometric point of view:—There appears to be a permanent depression in the vicinity of Cape Horn, probably in some measure connected with the immense depression noticed by Sir James Ross about the Antarctic circle, the mean barometer between the meridians of 80° W. and 20° W., lat. 50° to 53° S., is 29° 56′, from 359 observations; between 53° and 55° S. lat. 29° 37′, from 377 observations; south of 55° Cape Horn region, 29° 28′, from 1055 observations; in the same parallels of latitude, between the meridians of 20° W. and 140° E., the mean barometer is respectively 29° 35′, 29° 17′, 29° 27′. These observations should go far to prove that this depression is common to high southern latitudes.

The instrument throughout the Southern Ocean stands lower comparatively than in the northern seas. This depression may be attributed to the humid condition of the immense oceanic surface on the polar side of 40°, which I have already alluded to as a region of copious precipitation. According to Rosseu, a register of 1429 gales south of the parallel of 40°, gives the following results:—In 195 gales, blowing from between north and east, the mean of the barometer was 29° 46′; 84 between east and south, mean barometer 29° 43′; 502 between south and west, 29° 39′; 648 between west and north, 29° 30′. These were 14 per cent. of gales between north and east; 6 per cent. between east and south; 35 per cent. between south and west; and between west and north, the most stormy quarter, 45 per cent.

Gales frequently occur in the high latitudes of the South Atlantic with the barometer standing above its mean. As a general rule, northerly winds, more especially north-west, depress the barometer: it rises highest with winds from south-east to south-west. A great variety of opinion exists among navigators as to the utility of the barometer off Cape Horn. This I believe arises from not taking into consideration that the mean pressure is quite half an inch less than in a corresponding northern latitude. I have experienced very fine weather with a low glass; but I do not think there is any part of the Southern Hemisphere where the weather changes more rapidly than in the neighbourhood of Cape Horn.

The paper concluded with a few remarks on the magnetic phenomena of the Southern Hemisphere.

XXVI.—*On Peat, and its profitable Utilization.* By ROBERT M. ALLOWAY, M. A., J. P., &c.

[Read January, 1869.]

PEAT and its attempted utilization has been brought into much disfavour of late by mismanagement. Few are now disposed to believe in its practicability, but on the contrary are more inclined to consider with the London "Times," that the "one huge succession of bogs," which fill up a large portion of the central parts of Ireland, are useless and unsightly excrescences, growing over and covering up three million acres of good land. A few, perhaps, there may still be, who have not given up their old opinions, that Providence did not intend that so singular and coal-like a substance should always lie waste, but that it was capable of being made not only profitable, but of immense value, if rightly understood and properly treated. Being one of these latter, and having turned my attention specially to it for the last fifteen years, I think I may now safely put forward the results of my experience, and give a short account of the simple and economical process, which I have gone to the expense of patenting, as well as erecting a model manufactory at my own place in the Queen's County, where it can be seen at work in the proper season, that is from April to November.

About twenty years ago peat attracted considerable attention from its admitted family likeness to coal; or rather of its being, in fact, but coal in one of its earlier stages. It was thence thought that time might be anticipated, and an artificial condensation given to it, which would render it more coal-like than in the shape of common turf, and consequently more portable and valuable as a fuel. Sir Robert Kane, in his Industrial Resources of Ireland, says—"The characteristic fault of turf is its want of density, which renders it difficult to concentrate within a limited space the quantity of peat necessary for many operations," page 39. Several clever mechanics endeavoured to overcome this default, but though they succeeded in making a denser product, yet not one of them, from the first trials up to the present day, could do so except at a cost which left all commercial profit out of the question. When I began to study the matter, I soon became convinced that something beyond mere mechanical skill was required, and that this common and generally despised vegetable production demanded to be treated with the highest degree of scientific consideration and observation to ensure success in any attempt to utilize it. The first idea of the mechanical experimenters was compression. Geologists admit that the coal-beds (now lying in dense masses hundreds of fathoms deep in the earth's crust) were once on the surface as soft as peat. It was not, therefore, unreasonable, at the commencement, to conclude, that the great weight of superincumbent rock under which coal had been buried for ages (conjoined with heat from the internal fires), had produced its density and dryness. Compression and artificial desiccation were consequently the two first grand means proposed for this purpose, and appear so plausible and apt that they still haunt the imaginations of superficial observers. Scarcely a day passes when casual visitors come to see my peat works, but they say, "Don't you think, if you had some machine to compress the bog, that it would be much better than hand work?" Others say, "If you had roofs over your tables *to keep off the rain*, would not the peat dry the quicker?" My answer to the former is, that compression by machinery long since totally failed, the water in practice being found to be pressed *into* not *out of* the peat. As to having roofs over the tables, in the first place it would delay, not help the drying, which would then take three weeks in place of three days; and secondly, it would more than double the cost of the "plant," besides being exposed to damage from every high wind that blew. Drying by artificial heat is so stupid a notion as to be scarcely worth alluding to, wasting as much fuel of some sort or other, as would be dried of the condensed peat.

The most noteworthy of those, who some years ago turned their attention to this subject, were the late Lord Willoughby d'Eresby in England, with, in this country, Messrs. Jasper Rogers, Wye Williams, Rees Reece, Henry Gould, Henry Newton of Mount-Leinster, and more recently Mr. Charles Hodgson of Derrylea. I had the pleasure and advantage of an acquaintance with the four latter of these gentlemen, and freely and frequently mooted this matter over with them; giving them reasons for my objections to their different plans, with my opinion, that they were all working on wrong principles, depending on complicated machinery of too costly and unmanageable a description, besides other mistakes they made from their ignorance of the true nature of peat. The results in every case bore out the correctness of my views, for I am sorry to say, they heeded not my warnings, and after the lapse of a very few years, their several factories have been closed, and their expensive machinery either sold for old metal, or in ruins. No one has cause to lament their failures more than I have, for I find that I have to encounter the apathy and doubts which have followed from their too-palpable mistakes, the struggling against which is far more toilsome than my fifteen years of experimenting. The severe money losses, which have been incurred by those, who formerly so blindly trusted in mere words, have caused such a reaction, that few now will entertain the matter at all without suspicion, or almost believe their own eyes, or the most practical or simple proofs. I have met with three or four, who have exclaimed, "Peat! oh, don't talk to me of peat: I had £1000 (or £600, or £500) in Mr. So-&-So's Peat Company, and I lost it all." Thus the sins of my peat forefathers are unjustly visited on me, and their abandoned factories are so many scarecrows to warn off the nervous capitalist, who cannot judge for himself that two and two make four, or that there is a difference in point of permanence between a house built on a rock or on a sand bank; on a process founded on simple economical rules, and unquestionable calculations, or one which is all mystification and error, conjoined with unknown and endless expenses, putting profits out of the question.

These failures, particularly Mr. Hodgson's (who, in reality, was the only one who everbrought any condensed peat into the market), are, damaging to me, as there seems to be engendered a weak idea, that there is something impracticable or unlucky in peat; whereas the truth is, that the fault lies not in the peat, but in the ignorance of its peculiar nature among those who have hitherto attempted its improvement.— Its peculiarities, though stringent, are simple; and I have brought my process to such perfection (that I can confidently make it public), by seeking out, and attending to, those peculiarities. I have, in consequence, discarded, as impracticable and unprofitable, Lord Willoughby d'Eresby's hydraulic presses, Cobbold's cylindrical churns, Glynn's steam rams, &c., &c., with all kinds of hot air blasts, heated tables, hot flues, kilns, &c., and simplified, step by step, an economical, commonsense working plan, on plain, but scientific principles, by which a dense portable, wood-like (rather than coal-like) substance, can be made at once from the soft, wet peat, consolidated without pressure, and dried in a few days (generally three or four), by atmospheric evaporation alone. In arriving at this desirable result, I always kept in mind the laws of capillary attraction, and atmospheric evaporation, which govern so many matters of daily occurrence, small and great. I also took note of, and good care to avoid what I clearly saw were the causes of the break-down of others.

My process consists of two plain principles, which I trust will not be despised for their simplicity, nor their appearance of being only improvements on something done before, but which was rudely and badly performed. In reality there is "nothing new under the sun"—not even electricity, animal magnetism, or photography; but in all and everything there may be such improvements, that the scientific modern is as unlike the barbarous ancient as was Titian's first scrawl with charcoal on whitewash to the perfection of his Florentine Venus. Those who wish to disparage my process, may call it only the old hand-turf improved; but then the improvement is as great and the difference as much as exists between a wheel-barrow and a mail-coach. In place of machinery and hot plates or flues, I have enlisted the services of three grand natural wonder-workers, who do what I want without cost, payment, or grumbling—viz., in summer, the sun and the wind; in winter, the rain. In winter the rain lends great help to the mashing or pulping; in summer the sun and wind dry my product in much less time than any artificial heat or wind machine ever did, and at a twentieth part of the cost.

My first process is the mashing or breaking up of the raw material. Peat, being sponge-like, requires to be disintegrated. Well, there is nothing new, it may be said, in this. No, except that I do it in an improved way; I do quickly and perfectly, what was formerly done coarsely and slowly. This is the winter's work, at which men and boys alone are employed, and which, as I have said, is materially assisted by what in any other kind of work would be injurious, hail, rain, or snow. These help to dissolve the raw peat.

My second process is moulding the peat into "pats" or small sods (such as are in that grate and in those bags). No compressing machine, brick-mould, or other implement of the kind can do this like human hands, particularly those of women, or boys, or girls. They get so dexterous at it that they can earn much better wages than at any other farm-work. The whole process being done by task-work, the cost of labour can be ascertained to a penny per ton, while the expense of machinery (even if effective) would be quite uncertain, and would require more hands to attend it (besides its own cost and expenses) than I require without machinery. This moulding is carried on, as I have said, by women and children from April to November, on latticed tables of my own invention. It is easy and healthful work. The tables are cleared every three, four, or five days, according to weather, and the peat coal put into the storehouses, when a fresh batch is immediately placed on them, and so on through the entire season, until the frosts and long nights come on in the end of October, when the moulding ceases and the pulping for the next year commences. This healthful employment of young children from 10 to 15 years of age, may be a matter pleasing and interesting to some, and if my peat process were taken up and carried out on the large scale that is required, it would prove an admirable industrial school for the flocks of young boys and girls now rearing up in idleness and worthlessness in our poor-houses. Not one need be kept there all through the spring, summer, and autumn at least, during which period they would be made not only self-supporting, but have a surplus of wages at the end of the season to be applied to their benefit in some way. I recently saw upwards of sixty of them in the Mountmellick poor-house, moping dolefully in one of the yards, like so many little jail-birds, but who were all suitable for this work, which would change them into very different creatures in a short time. I have also a design of cheap lodging houses for them, if ever required, and a model one has been erected at my own place, as a sample.

The distinctive advantages of my peat coal over common turf are, 1st—That it can be made and dried in less than a week, ommcon turf requiring two to three months. 2nd—That it can be sent in bags or otherwise, like coal, to any distance by sea or land, without any waste whatever. 3rd—That, from being so much condensed, one cart will carry as much value in fuel as ten could do of common turf. The same proportion holds good in carriage and storage, &c. 4th—That the quantity of common turf that can be made is limited to the size of the drying ground, which will give but one crop in the season, whereas in the same space from 30 to 40 crops of peat coal can be produced. 5th—That, unlike common turf, there is no loss from waste of a single sod, either during the manufacture, carriage, storage, or use, from the time it leaves the peat tank until consumed in the fire-grate, nor indeed a particle of the original raw bog be thrown away, or left behind, as I have no refuse whatever, except the upper five or six inches of decomposed mould or bearing, which is on the surface of all bogs, and which, when thrown to the bottom and mingled with the underlying marl, would make a new surface or soil that would really be valuable for tillage or pasture, unlike the generality of cut-away bogs, which are almost always useless from the depth of the peaty refuse left there, frequently three or four feet deep.

As to pit coal, my peat can compete with it in price any where but at the "pit's mouth," or where the cost of carriage is small. It is preferable to it in many ways, being untainted by noxious gases, which are deleterious to health, and notoriously injurious to furniture, pictures, &c., &c. The preliminary expenses required for commencing a manufactory of full size will be found to be not a fiftieth of those necessary for sinking a coal pit, with no future risks or chances to calculate or allow for. All is open and visible work on the earth's surface in my plan. In fact, the first outlay would be less than that required for common tillage-farming, or land-stocking, not to speak of mining or other kinds of manufactures. The peat coal has been pronounced by competent authorities to be a first-class fuel for generating steam. I believe it will also produce a firm, hard charcoal (a thing hitherto unattainable from peat)—most valuable in iron and steel work. If it should ever become the general fuel of the large cities of England, then London, Edinburgh, and Dublin, &c., would enjoy as pure atmospheres as Paris. A great deal has been written and spoken about the Industrial Resources of Ireland. Here is one of the foremost and most peculiar of them, calling aloud to be utilized. Why is it not so? If my process be not what I state, let it go. But if, on strict investigation, I shall be found not to exaggerate its value, I cannot undeestand why it is to be ignored, when millions are spent on matters that, compared to it, are mere lotteries, where frequently losses are the rule and profits the exception.

A country gentleman of moderate means, working on his own demesne as I am, cannot be expected to do anything worth mentioning in a matter of produce that is actually of national importance, and required for national consumption. It is not hundreds of tons, but hundreds of thousands of tons, for which there is demand. The greater part of the labourers would be children, for whom at present there is no healthful or desirable employment. There would be immense value extracted from what is now looked on as worthless morasses; and a better and cheaper fuel produced for the use of all, raised in the country, in place of being imported. An imaginary personage has been lauded for making two blades of grass grow where only one grew before; and I do not think I am unreasonable in expecting a little share of a similar feeling, if I had only brought to perfection any one of the five or six improvements in peat that I have already enumerated. I do not particularly want to decry pit coal, but I would ask any unprejudiced person to contrast the wretched existence of coal miners with the joyous and healthy lives of the labourers on peat bogs, breathing pure air in the genial sunlight, in place of fetid underground vapours. It is astonishing to think of the amount of courage or stolidity (whichever it be) which induces the thousands of pit men throughout England still to encounter the irrepressible Fire-damp Fiend who daily decimates them, laughing at all the science of the world.

My peat farming can also compare favourably with common tillage or stock farming. It is not likely to be damaged by blights, birds, vermin, or insects, like corn or green crops. It is proof against diseases and fluctuations in value, or accidents, like cattle, &c. Even the worst kind of summer weather will not injure it like corn or common turf, but will merely delay the drying. The heaviest thunder shower will do it very little damage, and then only to what has been moulded fresh within two or three hours previously.

An investor in it need not allow anything for future losses, or for the sweeping off of profits by disease, blights, &c., above, or by sudden fire-damp explosions, or inundations below. There are no 500-fathom deep shafts to be sunk; no tremendous machinery required, costing fabulous sums; no breakage or leakage; no subterranean horrors; but all on the earth's fair surface, and in the pleasant light of day, where ladies may walk about, and see the rosy children actively and healthfully employed, in place of being shocked and pained at the pale faces and stunted forms of the prematurely-aged little boys and girls to be seen issuing occasionally from common factories.

I hope, therefore, that after the above statement (ready to be verified by proof) my peat process will be no longer neglected or ignored, as it has been for the last two years. I think I have done enough to devote my time and all my powers of observation and invention to this matter, with some money also, and that now capitalists or companies will think it to be for their interest to carry it out to the extent it deserves. In any other country but England such a process would be inquired into by the Government, and supported and promoted, if found valuable. Here, I believe, the Government declines to promote anything or assist any one, leaving it to the public to do so. I therefore make this my first, and probably my last appeal to the public through the best medium I know of, the Royal Dublin Society, the patron of scientific and practical industries.

The following outline of statistics may be sufficient at present to give a general idea of the process. More minute particulars can be afforded to any one inclined to carry it out on a large scale. I may premise that it is by the number of drying tables that my calculations are made as to the size of a manufactory: a full-sized one should consist of 10,000 tables, each thirty-six feet long by four feet wide, constructed simply but permanently of wood. These would turn out in the season (viz., from March or April to October or November, according to weather) 50,000 tons of peat coal; about five tons per annum, on average, being made from each table. This, if sold at only ten shillings per ton, would give a profit (*over every cost*) of £5000 per annum, being at the rate of twenty per cent. on the outlay for plant and manufacture. One hundred men would be required for this all the year round, with 400 women and children, in Spring, Summer, and Autumn—a very moderate number, if compared with the requirements of any other kind of manufacture. Messrs. Malcomson employ upwards of 2000 in their cotton factory at Portlaw alone; all living in the village and neighbourhood. Messrs. Hodgson, at their late peat factory, found work for nearly 300 people, principally men, *in addition to their costly machinery;* and yet they could not make as much condensed peat in six years as I can in one year, with only a third of the number of hands, and without the cost of machinery or the waste of other fuel in drying; the sun, the wind, and the rain doing the greater part of the work for me.

This full-sized manufactory would occupy 100 statute acres of bog, on which space the drying tables would stand, and from which the peat coal would be made. A brisk wind and unimpeded sunshine are nowhere found in greater perfection than on a large open bog. These are my sole drying agents. On a high deep bog also it is only required to open tanks at first, to have them filled with water in a day or two in almost any weather. A manufactory of half the above size, say of 5000 tables, would still be a considerable one, but the larger one better.

£10,000 is but a mere trifle compared with the enormous sums daily spent (often fruitlessly) on the first opening of coal or mineral mines, where all is chance and uncertainty. In this case there is no risk. All is above board, and those who invest in it will be sure of a suitable return for their money.

To exemplify the superiority of my peat coal over common turf, I add the following facts:—

One of my lots of model tables here stands on about an English (or statute) acre of bog. On this I have 150 tables, with space besides sufficient for store-sheds, tanks, &c. These will dry 750 tons of peat coal per annum, at a rate of five tons per table. These, if sold at only the lowest price—ten shillings per ton—would return (at two shillings a ton profit) 1500 shillings (£75). The same ground covered with common turf, spread out to dry, would, with difficulty, hold 500 standards (or boxes) of twenty cubic feet. This, if sold at £5 per 100 (the highest price), would give a profit over the cost of cutting and saving of only £17 10*s*., allowing £1 10*s*. per 100 for the labour. £75 against £17 10*s*. is a considerable difference. Common turf cannot be manufactured on a large scale, nor sent to any distance, whereas, to the manufacture of my peat coal there is no limit, nor is there any part of the world where it might not be transferred easier and cheaper than pit coal. Common turf also is wasted every time it is moved, while there need not be the loss of a "pat" from the tank to the fire-place with the peat coal. This is an important item in calculating its value and profit.

Mr. Neilson inquired the cost of production, and said that he used the refuse from coke for heating his greenhouses, and wished to know if peat would not be cheaper and better.

Mr. Waldron wished Mr. Alloway to explain the process he employed for pulping and drying the peat.

Mr. S. Sprowle has attended to peat for many years, and is familiar with most of the experiments. The preparation of heat by disintegration, and its treatment with water, was a well-known process, especially where the bogs were defective. In this case the peat was merely spread on the ground, and cut across at regular distances. A wet season would be very unfavourable to Mr. Alloway's process. Peat fuel as good as coal has been produced by others, but the cost of production has hitherto proved an insuperable obstacle.

Mr. J. J. Lalor asked Mr. Alloway what was the cost of manufacture of 200 tons of peat fuel he had made, and what it realized in the market.

The Chairman (Rev. Joseph A. Galbraith) observed that any attempt to develope the internal resources of the country must be of great interest to Irishmen; the most patient hearing and the greatest encouragement, and most favourable reception should be given to every one attempting it. Mr. Hodson had been a pupil of his own, and he considered him a very intelligent and practical man. It was the opinion of Mr. Anderson, formerly of Blackwall-street, a gentleman of great experience, that notwithstanding Mr. Hodson's failure, he believed the case to be a very hopeful one, and that he was convinced that Mr. Hodson would have succeeded if a commercial crisis had not unfortunately occurred at the time. What proportion would a ton of Mr. Alloway's peat bear to a ton of coals in price and heat-giving properties? Mr. Hodson's fuel was sold for 11*s*. per ton in Dublin; but Mr. Anderson said that it was not equal to coal in heat-giving qualities, though it answered very well under the boilers of engines. At what cost per ton could Mr. Alloway's coal be sold in Dublin market?

Mr. Copland, an experienced practical engineer, had attended to peat for twenty years. Peat solidified can be produced to make very good fuel as cheap on the spot as coal at the pit's mouth. The greatest interest was felt in peat everywhere but in Ireland, where it was of most importance. A trial trip had been made between Belfast and Portrush, a distance of seventy miles, and this was attended with the most favourable results; peat likewise answered well for stationary engines and steam boats.* It was found to do more work in a furnace than twice the weight of coal. The experiments in the North of Ireland had been tested by three engineers. The directors of one of the Irish railways had offered to contract for peat fuel at 18*s*. per ton. If properly conducted, the manufacture would be successful. Peat was found useless for the production of oil, as it only produces five per cent., and it was also useless for manure, as it consists only of charcoal, and the machinery erected for thus utilizing it was wholly misapplied. Mr. Hodson's system was defective; his peat fell to pieces in the furnaces; it made a bright fire, but was too expensive for domestic purposes. Mr. Copland was acquainted with Mr. Alloway's process; but though it had been successful on a small scale, he did not think it would answer on a large. 20,000 tons per year would be required to be produced to make it pay; but a woman could not make more than 200 pats daily. The amount of manual labour required is so great, that the operations can never be conducted on a sufficiently large scale.

---

* It is well known that the sulphur contained in coal is injurious to the furnace bars, and no such objection can apply to peat.

The CHAIRMAN said that, as far as his knowledge went, the best turf ever made was not comparable to coal, ton for ton; fuel must be valued according to the units of heat given out in combustion compared with the price.

MR. ALLOWAY replied, that he could prove to any one visiting him that his peat coal could be made, covering every expense, for less than 8*s.* per ton, and any sum over that would be clear profit. Condensed peat always burns well. Mr. Hodson's process was too expensive; he sold his peat for 12*s.* 6*d.* in Dublin, but it cost him double that sum to make it. Dublin was well supplied with coal, but three million acres of peat were scattered over Ireland, and it would be as well to establish factories in many different localities for local consumption. The Great Southern and Western Railway have offered to contract for it for 8*d.* per ton less than common coal. Peat is preferable to coal—much cleaner and healthier—and does not injure furniture. If peat was used instead of coal, the skies of London and Dublin would be as clear as those of Paris. In country places peat would be very profitable. In Portarlington coal costs 25*s.* per ton. A bag of Mr. Alloway's peat will burn longer than a standard of common turf, and could be sold for 10*d.*; Mr. Alloway's peat is so portable that a cart will carry as much as ten carts carry of common turf. A store in Dublin could have boats on the canals, and the peat could be sent for 1*s.* per ton. If 12*s.* per ton was then charged in Dublin, it would give a profit of 50 per cent. Peat answers much better than coke for greenhouses, as it gives off no noxious gases; it can also be used for steam-engines, stoves, &c. The heat produced was three or four times greater than that from common turf. During the winter Mr. Alloway employs men in his factory. Mr. Hodson employed 300 men; but with such a number Mr. Alloway could easily produce, without machinery, twenty times as much as Mr. Hodson, with all his machinery. The peat was mashed up by a machine of Mr. Alloway's own invention. Mr. Alloway's fuel might be called "hand turf," but it was greatly improved hand turf. In the spring, when the women and children could stand at the tables, the turf was wheeled in barrows of Mr. Alloway's invention from the peat-tank to the moulders. One man supplies from four to six moulders. The tables for the moulders are four feet wide and thirty-six feet long, and furnished with four-feet plastering laths. One slap shapes the peat; and in from two days, in very fine weather, to four or five, in bad weather, it is dried. In an hour a crust, impervious to wet, forms on the peat. Continued rain slightly retards the drying, but a slight shower accelerates it, and the peat dries quicker after it. It suffers nothing from rain in summer, while in winter, rain or snow accelerates the mashing process. Turf, when dried on the ground, absorbs dew every night. Mr. Alloway's, as soon as dry enough—which requires only a few days—is raked from the tables into wheelbarrows, and is then ready for market, or else is stored in wooden cases of open lattice-work. 1000 tables would cost £1000, i.e. £1 a table, covering all expenses; and in the season they would produce five tons per table; 5000 tons at 10*s.* per ton, would yield 20 per cent. profit; at 12*s.* per ton, 50 per cent. Common turf requires three months to dry; Mr. Alloway's is dry in three days. It is very uncommon for more than one crop of common turf to be obtained in the season; Mr. Alloway's process would yield thirty or forty. Mr. Copland tried his hand at Mr. Alloway's tables, and found *he* could only make one table, or 200 peats per day; but Mr. Alloway's trained hands could make from four to ten tables' full in a day. He paid 8*d.* per table, and children could thus easily earn 1*s.* per day a-piece. Coal cost 18*s.* per ton in

Dublin; peat coal—1½ tons of which would be equal to a ton of ordinary coal—could be sold for, say, 12*s.*

The **CHAIRMAN** complimented Mr. Alloway on his paper, and thanked him for the trouble he had taken in trying to utilize the internal resources of Ireland. He wished there were more gentlemen like Mr. Alloway, and he hoped he would bring the subject forward again.

MR. FLANELLY then read his paper on "Weights and Measures, and Commercial Arithmetical Calculations."

THE CHAIRMAN said that he would be very sorry to see any other system of weights and measures adopted than the Metric System. The interest in this subject has finally extended to Dublin. It has already been brought twice before the House of Commons, and on both occasions a large majority supported the second reading of the Bill. A Bill to make the adoption of the Metric System compulsory was brought in by the late Mr. W. Ewart. The second reading was carried by a majority of over 100. A permissive Bill was finally passed as a compromise, so that the Metric System is now part of British law. Last session another Bill was brought forward by Mr. S. R. Graves, member for Liverpool, to make the adoption of the Metric System compulsory; the majority then obtained, with a different Government, was over 200. It was again withdrawn at the request of Government. Two Parliamentary Commissions have strongly recommended its adoption. In case the Metric System was adopted, Mr. Flanelly's communication would be utterly useless, as it was founded on the present bad and confused system. A good system of weights and measures should have three characteristics:—(1) it should be international—the Metric System was so, and had been adopted by 180,000,000 of people in Italy, Switzerland, France, Belgium, North Germany, Sweden, Papal States, &c.; (2) it should be decimal—Mr. Flanelly's system was neither international nor decimal, and should therefore be rejected; (3) there should be a simple relation between weight and volume. A relation certainly exists in Mr. Flanelly's system, but not so rational as that of the Metric System. The value of the Metric System was now admitted by 180,000,000 of civilized people, whose opinion and practice must carry great weight. The only possible objection to adopting the Metric System was the difficulty of making the change. With reference to the Tables proposed by Mr. Flanelly, the Chairman observed that they did not differ in principle from M. Laundy's Table of Quarter Squares.

MR. FLANELLY replied, that tables of quarter squares were published 200 years before Mr. Laundy's. Mr. Flanelly's system adapted them to our coinage and weights and measures. The Parliamentary Committee had reported against any change in weights and measures, unless a system of decimal coinage could be introduced with it. (This statement was disputed by the Chairman.) Mr. Flanelly reasserted that the Committee had reported against decimal coinage; and that, without decimal coinage, any change would only increase existing confusion.

MR. VEREKER maintained that the Committee had reported very strongly in favour of both decimal coinage and the metric system. He objected strongly to ordinary calculations being superseded by the use of tables. Boys who had been brought up to the use of tables were found to have become mere machines, and useless in business.

DR. MOORE'S paper on "An experiment in the Cultivation of Kohl-Rabbi" was, in consequence of the lateness of the hour, taken as read.* Dr. Moore then exhibited a specimen of the cocoa plant (*Theobroma Cacao*) in fruit. It was the first time he had ever seen or heard of its fruiting in Ireland or Great Britain. The plant belongs to the natural order Bignoriared; and though the flowers of this order are usually very handsome, the cocoa flower is so inconspicuous that any one might pass by a plant in full flower without noticing it. Another peculiarity was, that the flowers are produced on the hard wood. The fruit, on the contrary, is extremely conspicuous. From one and a-half to two million pounds of chocolate are used annually in Britain, and in some countries the consumption is much greater. He supposed the fruit exhibited to be only two-thirds grown; but it was as large as a full-grown specimen, which he exhibited, received from Demerara. He also showed specimens of the seeds from which cocoa and chocolate are produced, received from Demerara at the same time. Dr. Moore thinks our hothouses are too damp to allow the cocoa plant to fruit, and that the unusually hot and dry summer led to the present fruiting. The fruit was first observed two months ago, when very small. Like the mango, the cocoa plant flowers very freely every year, but never produces fruit under ordinary circumstances.

---

* In Germany, during continued rain, it has been found that the wet is apt to lodge in the crown of the plant, which then decays. This would be a very strong objection in the wet climate of Ireland.

XXVII.—*The Metric System of Weights and Measures.* By the Rev. J. A. Galbraith, F. T. C. D., Erasmus Smith's Professor of Natural Philosophy in the University of Dublin; being the substance of a Lecture delivered on Saturday, March 20, 1869.

IMPORTANCE OF THE METRIC SYSTEM.

In the year 1862, a Committee of the House of Commons reported unanimously in favour of the adoption of the Metric System of Weights and Measures.

In the year 1864, an Act of Parliament, 27 & 28 Victoria, c. 117, was passed, which rendered permissive the use of Metric Weights and Measures within the United Kingdom.

On the 13th May, 1868, a Bill was brought in by Mr. Ewart to render the use of the Metric System compulsory within three years. This Bill passed a second reading by a majority of 219 to 67, or more than three to one, and was withdrawn, at the request of Government, only because it was too late in the Session, and the House was greatly occupied with the Reform Bill.

The Jurors of the International Exhibitions of 1851, 1855, 1862, and 1867, all agreed to recommend its general adoption by civilized countries.

The International Statistical Congress, held at Brussels, Paris, Vienna, London, Berlin, and Florence, reported in favour of its adoption.

There is a permanent Committee of the British Association, called the Metric Committee, whose object is to forward the adoption of this system, for the sake of the benefit it would confer upon scientific investigators, engineers, and students in the various arts and sciences.

The Metric System is, at present, used throughout Europe and America by a population of 150 millions of people.

Nearly 60 per cent. of the total export and import trade of the United Kingdom is carried on by people using the Metric System.

ESTABLISHMENT OF THE METRIC SYSTEM.

The establishment of the Metric System is erroneously ascribed in this country to the revolutionary desire for innovation which prevailed in France at the close of the last century.

In the reign of Louis XIV. the inconvenience and confusion arising from the variety of weights and measures were so strongly felt, that a Royal Commission, consisting of Amontons, Picard, and Huyghens, was appointed to investigate the question, and report on some suitable standard for regulating the weights and measures of the kingdom. This Commission was broken up by the revocation of the Edict of Nantes, which banished the illustrious Huyghens from his adopted country. During this reign and the following, several measurements of the earth were made, with a view to fix on a natural standard.

In the month of April, 1790, M. Talleyrand presented a Report in the first Session of the National Assembly on the uniformity of weights and measures. In the following month it was decreed by the Assembly, that his Majesty should write a letter to the King of England, to invite his co-operation in the establishment of an international system. It was proposed that a Committee, consisting of equal numbers of the Members of the Royal Society of London, and of the Academy of Sciences of Paris, should be appointed by joint authority to carry out this great measure.

The hostile relations which soon arose between England and France rendered the realization of this generous proposal impossible; and, accordingly, the completion of an international system mainly devolved upon the French people.

A Commission was finally appointed, half French and half foreign, to complete the measure. After a lapse of nine years, the final Report was presented to the Corps Législatif, together with a standard meter, and standard kilogram, which have ever since been preserved in the Archives of the State.

THE METRIC SYSTEM INTERNATIONAL.

The fundamental principle of the Metric System is that it should be International. This appears from the Report of the Academy of Sciences, signed by its President, Cordorcet, and presented to the National Assembly in March, 1791, by M. Talleyrand.

The Report states that, after careful consideration of the question, the Academy had come to the conclusion, that every arbitrary consideration should be excluded from the proposed system; that it should not possess any feature which could raise even a suspicion of the particular interest or influence of France. In a word, the Academy desired so to frame the system, that if its principles and details alone, apart from its history, should descend to posterity, it would be impossible to divine by what nation it was designed or executed. "l'Academie a voulu, en un mot, que si les principes et les détails de cette opération pouvaient passer seuls à la postérité, il fût impossible de deviner par quelle nation elle a été ordonnée ou exécutée."

PROGRESS OF THE METRIC SYSTEM.

It is commonly supposed that the French people readily adopted the Metric System as established by the Republican Government. The fact is far otherwise. The opposition on the part of the retailers and artisans became so difficult to control, that a decree of the Consular Government, 13th Brumaire IX. (4th November, 1800), was passed, permitting the use of the old names for the new weights and measures. This decree only served to introduce blind confusion into all sorts of business.

By an Imperial Edict, 12th February, 1812, this decree was repealed, and the "système usuel" was established. According to this system the metric standards were divided according to the old method; the scientific nomenclature abolished; the Metric System, in fact, was strangled in France, the country which gave it birth. The great Emperor was too busy with his ambitious plans of conquering Europe with the sword to bend his attention to the peaceful conquests of science, industry, and commerce, on which the true greatness of a nation depends.

During the Restoration not many efforts were made to improve the social condition of France; and, accordingly, the Imperial Edict remained in force until the reign of Louis Philippe.

In the year 1837, the Legislative Chambers, moved by numerous petitions, repealed the Imperial Edict, and simply re-enacted the Republican decrees of 18 Germinal III., and 19 Frimaire VIII., declaring that, on and after the 1st January, 1840, all weights and measures of any other standard or denomination than those of the Metric System should be illegal.

Since that period, the Metric System, has been very generally adopted by civilized nations. Its progress after its resuscitation, as above described, has been nothing less than wonderful.

Countries in which the Metric System has been wholly adopted.

	Population.
France, with Algiers,	40,500,000
Belgium,	5,000,000
Netherlands and Colonies,	23,000,000
Italy,	24,000,000
Papal States,	700,000
Spain and Colonies,	21,000,000
Portugal and Colonies,	8,000,000
Greece,	1,200,000
Mexico,	8,000,000
Chili,	1,600,000
Brazil,	8,000,000
New Grenada,	2,000,000
Other South American Republics,	3,000,000
	146,000,000

Countries in which the Metric System has been partly adopted.

	Population.
Switzerland,	2,500,000
Hanse Towns,	500,000
Denmark,	3,000,000
Austria	37,000,000
	43,000,000

Countries where it is Permissive.

	Population.
United Kingdom,	29,000,000
United States of America,	31,000,000
Prussia and North Germany,	30,000,000
	90,000,000

On June 13th, 1868, the North German Parliament passed an Act adopting the Metric System, and declaring its use permissive from 1st January, 1870, and compulsory on and after 1st January, 1872.

According to a despatch to the Secretary of State, dated 6th November, 1868, the Government of India has adopted the kilogram, with its decimal multiples and sub-divisions, as the unit of weight for British India. As to measures no decision has been arrived at for the present.

POPULATION OF COUNTRIES WHICH HAVE ADOPTED THE METRIC SYSTEM.

Adding to the population of the Countries enumerated above, the population of North Germany.

	Population.
Countries which have adopted the Metric System,	176,000,000

POPULATION OF COUNTRIES WHICH HAVE PARTLY ADOPTED THE METRIC SYSTEM.

Adding 140,000,000, the population of British India, to the countries enumerated above.

	Population.
Countries which have partly adopted the Metric System,	183,000,000

PRINCIPLES AND NOMENCLATURE OF THE METRIC SYSTEM.

1. It is international. Its framers intended it to be so, and so well carried out their principle, that nearly 360,000,000 people have already adopted it either wholly or in part.

2. Its principal units are derived from natural standards; the dimensions of the earth, and the weight of water.

3. It is rational, because all its parts, proceeding regularly from the unit of length, are connected together by rational relations.

4. It is decimal, that is to say, all its parts are multiples or submultiples of the number ten on which our arithmetic is founded.

5. The nomenclature is simple, expressive, and well adapted for international use. It consists of only eleven words. The name of each weight or measure tells its own story, and as all the words are derived from the Greek and Latin languages, in which all civilized countries have an equal interest, no national sentiment is interfered with.

UNIT OF LENGTH.

To establish the unit of length, the Commission appointed by the Republican Government proceeded to calculate the length of a quadrant of the earth, from the measured length of an arc of the meridian, the extremities of which were Barcelona and Dunkirk, stations which are nearly north and south, and comprise about 10° of latitude, situated very nearly equally on each side of the mean latitude 45° North. The linear standard used in this survey was the toise of Peru, so-called from its having been used by Lacondamine, in the year 1756, in the measurement of the Peruvian arc. This toise or fathom was divided into 6 feet, the foot into 12 inches, and the inch into 12 lines. The calculation founded on the measurement of the Barcelona-Dunkirk arc gave as the length of the quadrant of the meridian 5130740·75 toises, or 4432959964·8 Lines.

The ten-millionth part of this was selected as the Meter or unit of length. Therefore

Meter = 443·296 Lines.

UNIT OF LAND MEASURE.

The unit of land measure is the Are, and is equal to a square, having for its side a line of ten Meters.

UNIT OF CAPACITY OR OF LIQUID AND DRY MEASURE.

The unity of capacity is the Liter, and is equal to a cube, having for its side one-tenth of a Meter.

UNIT OF WEIGHT.

The unit of weight is the Gram, and is the weight of a cube of cold water (4° C.), having for its side one-hundredth part of a Meter.

MULTIPLES AND SUBMULTIPLES.

The multiples of these units are expressed by prefixes taken from the Greek language, and are as follows:—

Deca,	signifying	Ten times.
Hecto,	,,	Hundred times.
Kilo,	,,	Thousand times.
Myria,	,,	Ten thousand times.

The submultiples are expressed by prefixes taken from the Latin language, and are as follows:—

Deci,	signifying	Tenth part.
Centi	„	Hundredth part.
Milli,	„	Thousandth part.

SYNOPTIC TABLE OF THE METRIC SYSTEM.

Units.

METER—ARE—LITER—GRAM.

10000 times Myria.		
1000 „ Kilo.		
100 „ Hecto.		
10 „ Deca.		
	Unit.	
		Deci, . . . 10th part.
		Centi, . . 100th „
		Milli, . . . 1000th „

FORMATION OF TABLES.

The Tables of Length, Land Measure, Capacity and Weight, are readily formed by placing the respective units in the place of unit in the Synoptic Table:—

Length.	*Land Measure.*	*Capacity.*	*Weight.*
Myriameter.			
Kilometer.			Kilogram.
Hectometer.	Hectar.	Hectoliter.	Hectogram.
Decameter.		Decaliter.	Decagram.
METER.	ARE.	LITER.	GRAM.
Decimeter.		Deciliter.	Decigram.
Centimeter.	Centiar.	Centiliter.	Centigram.
Millimeter.		Milliliter.	Milligram.

It may be observed that some of these Tables are more extensive than others; according to the nomenclature they should be equal, term for term, but practice has determined the limits, as given above.

RELATION OF WEIGHT AND LINEAR MEASURE.

According to the Metric System, the unit of weight, or the gram, is the weight of a cubic centimeter of water; therefore, one thousand of these, or one Kilogram, is the weight of a Liter or cubic decimeter of water; one thousand Kilograms is the weight of a cubic Meter of water. This weight is called a Millier, or Metric Ton.

METRIC UNITS EXPRESSED IN ENGLISH MEASURES.

The following table of values is the result of exceedingly accurate measurements and calculations:—

Meter = 39·370790 inches.
Are = 119·60333 square yards.
Liter = 61·02705 cubic inches.
Kilogram = 15432·348 grains troy.

APPROXIMATE EQUIVALENTS.

The following Table of approximate equivalents answers very well for calculations in which extreme accuracy is not required:—

Length.

1 meter = 3 feet, 3 inches, 3 eighths.
64 meters = 70 yards.
25·4 millimeters = 1 inch.

Land Measure.

1 are = 4 perches.
10 ares = 1 rood.
1 hectar = 2½ acres.

Liquid and Dry Measure.

4½ liters = 1 gallon.
1 hectoliter = 22 gallons.

Weight.

1 kilogram = 2·2 lbs. av.
30 grams = 17 drams av.

Linear Square and Cubic Measure.

10 meters = 11 yards.
10 sq. meters = 12 sq. yards.
10 cub. meters = 13 cub. yards.

HOW TO MAKE A METER.

Measure off on a slip of wood 3 feet 3 inches and 3 eighths, divide this length into 10 equal parts for decimeters, into 100 equal parts for centimeters, and into 1000 equal parts for millimeters.

This meter is larger than the standard meter by only one part in ten thousand, and may, therefore, be considered as practically accurate.

HOW TO MAKE A LITER.

Take a piece of card-board, and on it construct a square whose side shall be 3 decimeters; subdivide this into 9 square decimeters, cut away the corner squares, and bend up those which remain into a cubical vessel.

HOW TO MAKE A KILOGRAM.

Balance a liter on a pair of scales with an exact counterpoise; fill the liter with cold water, the additional weight required to restore the balance will be a Kilogram. One-thousandth part of this will be a Gram.

RETENTION OF THE POUND WEIGHT.

In countries which use the Metric System, the pound is just as familiar as with ourselves. The half kilogram, or weight of 500 grams, is universally called the pound, and is used in retail transactions. If this weight be called, as it is in Prussia, the new pound, we should have

10 new pounds = 11 lbs. av.

Prices by the pound should, therefore, be increased by 10 per cent. if we adopted the Metric System.

Since 10 meters = 11 yards, the same observation may be made as to prices by the yard.

DISTURBANCE OF TRADE.

The prices of nearly every commodity are quoted by the

Hundred weight = 112 lbs.
Ton = 2240 lbs.

These weights are only $\frac{1}{63}$rd part more than the corresponding weights used in Continental business—namely,

Centner = 50 kilograms = $110\frac{1}{4}$ lbs.
Ton = 1000 kilograms = 2205 lbs.

The consequent change in quotations would amount only to $3\frac{3}{4}$*d.* in the £1: a change so trifling would cause little or no disturbance in daily business.

The Lecture was illustrated by a complete collection of Metric Weights and Measures from the Museum of Trinity College.

The Council of the Royal Dublin Society has ordered a similar collection for public exhibition.

The length of the side of this square is a Decimeter. Of such lengths,

10 = 1 Meter.

Of such squares,

100 = 1 square Meter.
10,000 = 1 Are.
1,000,000 = 1 Hectar.

A Cube standing on this square is a Liter. Of such cubes,

1000 = 1 Cube Meter.

The weight of a Liter of water is a Kilogram.

Weight of a cube meter of water = 1000 Kilograms = 1 Metric Ton.

XXVIII.—*The Wonders of the Blood and its Circulation.* By E. D. Mapother, M. D., Professor of Physiology, Royal College of Surgeons, and Surgeon to St. Vincent's Hospital, being the substance of a Lecture delivered on March 27, 1869.

A medical lecturer, appearing before a mixed audience, has to steer between the difficulties of uttering to his professional and scientific hearers statements with which they are familiar, and of detailing facts in technical language which the uninitiated cannot understand. Conceiving the purpose of this course to be to interest and instruct the general public, I shall use the simplest words I can find, and I at once crave the indulgence of my learned hearers if I talk about points which to them must seem elementary. All plants, as well as animals, are permeated by a liquid from which they derive their nourishment, but throughout these two kingdoms of the organic world the liquid becomes gradually perfected. In plants and the invertebrates it is a colourless sap or juice, but in the vertebrates are added those objects of intense interest—the red cells. This little fish—the lanceolet—indeed, has blood in which no red cells have been discovered, and in this particular and many others must be regarded as a connecting link between the two grand divisions of animals. The importance of blood is also indicated by the fact that it is the first of the bodily constituents which appears in the embryo. The main purpose of this fluid is to make good the loss of substance which the solids suffer in performing their functions. No muscle can move, nor can the brain originate a thought, without yielding to the consuming fire of oxygen, part of itself. The blood, however, not only supplies materials to repair the breach, but also carries away the *debris*. That a stream of rich pure blood shall flow into every tissue of the body, therefore, is an essential condition of its life, and there is scarcely any organ which does not subserve this all-important fluid. The digestive organs prepare for it, from the ton and a half of food we yearly take, a fresh store; the liver, lungs, skin, and other parts relieve it of the waste stuff of the tissues, which would clog and poison it if retained, and its distribution is accomplished by the heart and bloodvessels—these marvels of creative perfection, which, more than any other parts of animal construction, have awed and instructed natural philosophers. This living stream has often been likened to a river—some such river as the Thames—which feeds towns with water, affords an easy mode of conveying supplies to the houses as it passes, and, besides, bears away their waste. But the comparison is inappropriate, for, in the case of the river, the means for the removal of pollution are inadequate, and, indeed, in bearing such a burden, its natural function is perverted. Into the blood, however, substances foreign to it, and excessive quantities of its fit materials, may be thrown without hurt, so perfect are the organs for their separation or for their storage, accordingly as they are wanted or not. One instance will suffice—we cannot thin or thicken our blood by the quantity of water we take. If two dogs were bled to-day, and the proportions of water in their blood ascertained, they would be the same this day month if one drank pints of water daily, and the other not a drop.

Spouting from a wounded vessel, blood seems a red, simple liquid, warmed with the vital heat, but how complex it is I can demonstrate by four modes of analysis. The microscope will show wonderful intricacy; the spectroscope will exhibit in it more metals than you would find in a hardware shop; chemical tests will show a score of other substances; and a few minutes after blood is drawn, it will of itself separate into two, or sometimes three, constituents. Two hundred years ago Malpighi discovered that the blood swarmed with little objects, the red cells. The oxyhydrogen microscope enables us to throw on the screen an image of the human blood cells magnified some hundred times. In this figure they are seen on surface (*a*), edgeways (*b*), adherent (*c*), swollen (*d*), transparent (*e*), and shrivelled by sherry (*f*). You see they are beautifully regular disks, like coins, but so minute that they measure but 1·3000 part of an inch across, and 80·000,000 of them could be packed in a cubic inch. They are hollow, with a wall so tough that you will see them bear a squeezing as they struggle abreast through vessels not much bigger than themselves, and shrivel or swell accordingly as you put them in a thick or a thin fluid. They are round in all mammals except the camel tribe, in which, as well as in birds, reptiles, and fishes, they are oval. They are largest in this little proteus—namely, 1·400 part of an inch long—so that they are almost visible to the naked eye; and smallest in this musk-deer—namely, 1·12,000, or only one-fourth the size of those of man. On the screen we will now show you these cells from various animals. You see they do not tally with the size of the animal, but they are proportional to the size of the bone cell of each, as I show you by these images of the sections of bone of man and of the crocodile. The size and shape of the blood cells of various animals are so definite, that blood-stains on weapons or clothing can be referred to the animal from which they came, and this knowledge has helped to detect the murderer, or acquit the wrongly-accused. Their number in various animals is proportional to the vigour of breathing—least in reptiles, greatest in birds; and this fact indicates their use, which is to greedily seize the oxygen of the air in our lungs and to hurry it to such places as our brain and muscles. These organs, in acting, yield up some of their substance to be burned with this oxygen, and thence carried out of the system, as carbonic acid and some other products. At the same time the cells act as the distributors of the heat which is evolved in the making and destroying of tissue, and thus an equal temperature of 100° is kept throughout the whole body. The duration of their life is not agreed on by physiologists, some believing

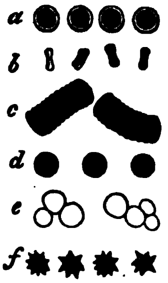


Fig. 1.

that they are being destroyed and replaced in millions every moment of our existence, while others hold that each cell enjoys a permanency of office as carrier of oxygen. It is in the liver the worn-out ones perish, and in the bile there is found their remains, and from the chyle and lymph, fluids, we may call our white blood, their successors are recruited. In these fluids are minute particles, and large round cells, either or both of which transform into the red cells of blood.

The matter of the red cells is easily recognized by the spectroscope characteristic appearances being produced when arterial blood and venous blood are placed so as to interrupt the spectrum. The experiments you will now witness you owe to Dr. Reynolds, the able chemist of the Society, who has most freely aided me in illustrating this lecture. You are aware that by the prism or by drops of rain in forming the rainbow, light is decomposed into a range of seven colours, which is called the spectrum; but if arterial blood be interposed, two dark bands seems to obstruct the red and yellow colours; and, if venous blood be used instead, one broad band intercepts the orange colour. The peculiar bands of arterial blood or the single one of venous may be exchanged accordingly, as the venous blood is changed into arterial by oxidation, simple exposure to the air being enough, or the arterial made venous by abstracting its oxygen with tartrate of the protoxide of iron. A single blood cell—you remember how minute that is—is enough to show these bands on the spectrum, and putrefaction does not destroy these curious properties. Blood-stains may be also detected in this way; but, as the blood of all animals displays the same characters, the test is not so instructive as the microscopical appearances. The spectroscope also enables us to show the many metals which exist in blood, for each gives a distinct spectrum. Now, instead of the seven spectral colours you only see a line of yellow; that is evidence of the presence of sodium, even, if there be but the ten millionth of a grain. Now, calcium, the metal of lime, shows these five distinct lines; and, if the person whose blood we are examining was using lithium, the sovereign remedy for gout, or took a dose of it to make the specimen, this red band would be the spectrum, and so on for several metals. This wonderful instrument may not only allow metals and the poisons derived from them to be detected, but the materials which produce various diseases may thus be some day exhibited. Iron is always in the blood—faintly in the green-sick girl, plentifully in the ruddy countryman; and, if the latter were to die, his sorrowing relatives might have a mourning ring made from the iron his blood would yield.

A test just discovered in Australia shows extraordinarily small quantities of blood in stains, even twenty years old. It is a mixture of tincture of guaiacum and peroxide of hydrogen, and you see with blood a beautiful blue colour is developed. If water alone were to circulate through our vessels, it would ooze out and make us dropsical; but "blood is thicker than water," because of the albumen it contains, and therefore stays in the vessels. You see when I heat the fluid of the blood a white mass is separated, just as from white of egg, and this is albumen, the model feeding principle. Of the composition of the blood of animals I will only further say that it is identical with that of their flesh, as proven by Dr. Playfair, now member for Edinburgh University. For that and many other reasons, in 1863, I advocated the keeping of blood in the carcases of the animals we slaughter. Dr. Foot has lately told us that the lions in our Zoological Gardens are fed with flesh in which the blood is retained. They have enriched the Society with numerous healthy cubs, while the lions in the London Gardens, fed on meat butchered in the usual way, have produced a scant, deformed, and sickly progeny. The composition of the blood varies surprisingly in different diseases, and thus physicians are led to hope that with the invaluable aid of chemistry the cause and cure of many an obscure and fatal malady will be discovered. The paleness of the consumptive, the bloatedness of the apoplectic, and the yellowness of the jaundiced, notably indicate changes in the quality of the blood; but the most profound alteration occurs in cholera, more than two-thirds of the water of the blood being removed. The avidity with which the supply of water is sought to be replenished is shown by the fact that when cholera seizes a person suffering dropsy, that disease magically disappears.

The blood may be invaded by parasites, for a little animal, the Distoma Hematobium, and a plant, the Bacterium, have been often found in it, the latter probably causing in the ox a long list of diseases, of which splenic apoplexy is the gravest. Under this microscope you will see ox blood infested with Bacteria. The scientific study of the diseases of lower animals would so greatly benefit human medicine, as well as promote the agricultural interests of the country, that I greatly regret the Science and Art Commission have not advised any plan for teaching the Veterinary Profession in Ireland, or for the scientific study of the diseases of lower animals. That the blood of the ox affected with splenic apoplexy may infect man was proven by a case which Professor Ferguson showed me last month. If we allow ourselves to theorise, we may fancy that all catching diseases are owing to parasitic invaders of a special kind for each contagion. The resemblance of fermentation to the spread of what we call zymotic diseases favours such a theory. Exclude the yeast plant from syrup and it remains unaltered, but add one of these microscopic plants, and millions of them will be developed at the expense of the sugar. In the same way, keep, by a cordon, an ox free from all chance of contagion, and his blood is safe; but into it introduce a drop from the veins of a second ox with cattle plague, and the contagium of that pestilence will become multiplied so many millions of times, that all the herds of Europe might be infected from it. Of small pox and some other poisons which afflict man, the story is the same, for by them

> " The life of all his blood
> Is touched corruptibly."
> " ——And there the poison
> Is, as a fiend, confined to tyrannise
> On unreprievable, condemned blood."

In another play, also, Shakspeare describes with marvellous skill a blood-poison,

> "Whose effect
> Holds such an enmity with blood of man
> That, swift as quicksilver, it courses through
> The natural gates and alleys of the body,
> And, with a sudden vigour, it doth posset
> And curd, like eager droppings into milk,
> The thin and wholesome blood."

That the poet had a kind of foreknowledge of the circulation which Harvey discovered a quarter of a century after would appear from many passages. For instance, the following is a most accurate account of the course of blood in fainting, as well as of the fit restorative from that condition:—

> "O Heavens!
> Why does my blood thus muster to my heart,
> Making both it unable for itself,
> And dispossessing all my other parts
> Of necessary fitness?
> So play the foolish throngs with one who swoons;
> Come all to help him, and so stop the air
> By which he should revive."

In different races the composition of the blood varies, but this depends more on such circumstances as exercise, food, and air, than upon hereditary characteristics. I am sure no chemist could distinguish "the blood of all the Howards" from that of the humblest peasant, if both for a while were dieted alike. In the blood of the thorough-bred horse there is less fibrin than in that of the hackney, but this is owing to the pampered life of the one, and the toilful life of the other.

The fourth analysis of the blood I have alluded to is a spontaneous one—namely, the separation of the clot and serum, which occurs as the liquid coagulates a few minutes after it escapes from the body. This occurrence is very characteristic, indicates the life of the blood, and, what is remarkable, it will take place when blood which was frozen is thawed, even months after it was removed. At first the blood congeals into a liver-like mass, out of which a colourless liquid is slowly squeezed, and, in about twenty-four hours the liquid is twice as large as the firm clot, as here represented. The material which causes the clotting is called fibrin, from its mode of setting into interlacing threads, which entangle the red cells in their meshes. That the fibrin only exists in blood poured out, and is then an altered condition of the white cells, I have for many years believed. That it is the fibrin which clots the blood may be proven in various ways. This bowl of blood was whipped with twigs just after it flowed from the ox, and the threads on this plate are the fibrin; the remaining blood you see remains fluid. Again, frog's blood can be filtered; for the cells are very large, and the colourless liquid which goes through contains the fibrin, and

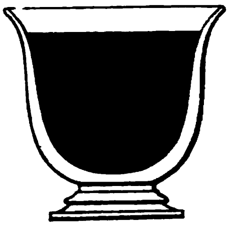


Fig. 2.

therefore clots. Fibrin is the most variable of the constituents of blood, for, in inflammations or rheumatism it may be trebled or quadrupled. This clot, the upper fifth of which is pure white fibrin, was taken from a man with rheumatism. It is a valuable specimen; for the lancet, a few years ago employed so constantly, is now almost an obsolete instrument. In clotting, blood gives off ammonia, as I could have shown by holding a little hydrochloric acid over this blood, just after its removal from the ox. For the essay in which this fact was announced, Dr. Richardson, of London, obtained the Astley Cooper prize of £300; but in the writings of the Hon. Robert Boyle, in 1684, the fact is mentioned. The fact that the blood drawn by a leech does not clot has often puzzled me; but I think it is due to the smallness of the puncture made by the animal's teeth, for the blood is so slowly delivered that time is allowed for the surrounding tissues to pick out the fibrin. Clotting is all-important, for without it the slightest wound would prove fatal. If one of our Vartry pipes bursts—a phenomenon you may have witnessed—out the water squirts, till the plumber stops the breach; but a wounded artery is plugged by the clotting of the blood most effectually, as you will see by this specimen, and this enlarged representation of it. For this purpose the blood of every animal contains fibrin, while, you remember, the vertebrates alone have red cells.

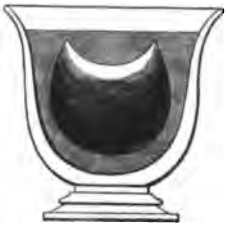


Fig. 3.

Baron Haller, judging from the quantity shed in cases of bleeding, guessed that we had 28lbs. of blood. However, a person bleeding for three or four days will pour out more blood than the body may have contained at the start, and a fresh supply will be made, and the thirsty vessels will suck the moisture from the tissues about them. Twelve pounds is a probable average. A meal will greatly increase the quantity of blood, for twice as much may be drawn from a rabbit well fed as from a fasting one; and for this reason, before battle, or before the surgeon uses his weapons, rapidly nutritive food should be given.

You have all probably heard that loss of blood in one person may be made good from the vessels of another; that, for instance, the dying wife may revive if the husband lend his blood. Such an heroic individual should be well fed for his own sake, as the loss will be more readily borne, and for the sake of her to whom he devotes his blood, for that fluid from a fasting person is poisonous rather than revivifying. With equal absurdity and irreverence this transfusion was at first looked on as a means for indefinitely prolonging existence; but it has saved many lives, and has added some hours of inestimable value to the lives of cholera victims. In the throwing in of the blood the greatest caution is needed, for the entrance of a few bubbles of air may be fatal. The blood of one animal, even in very minute amount, is fatal to another of a different class—a fact which the varying size of the cells does not explain.

After all, the most wonderful thing about the blood is the inimitably constructed system by which its distribution is effected. Time permits me only to describe the course of it in the smallest vessels—the capillaries—some of which are so narrow as to admit but a single blood-cell. These vessels are so closely interwoven that the finest needle cannot be thrust into the skin without wounding some of them. When the web of the frog's foot, or the tail of a minnow, quieted by chloroform, is placed in the field of a microscope, the circulation is readily seen. To make it more generally visible, we will try to throw the image on the screen, but if we fail you will have to examine it by those microscopes on the table. The annexed figure shows these appearances. It is just as if, on the map of a country, all the rivers and their tributaries were set flowing. Here the cells are entering by an artery—here they leave by a vein; while, in the intermediate capillaries, they pass two or three abreast, or singly struggle through, according to the size of the passage. As in a river, the current is quicker in the centre, and along the sides the white cells move so sluggishly, that it was supposed there was there a still layer. But this slower flow allows the blood and the tissues around to exchange materials, and, in doing so, the onward course of the blood is promoted, for a fresh supply is wanted, accordingly as the fluid is used up in the building of the solids. You see the red cells rush impetuously, bringing with them in the arteries destroying oxygen, and in the veins the *debris* of the tissues that gas has consumed.

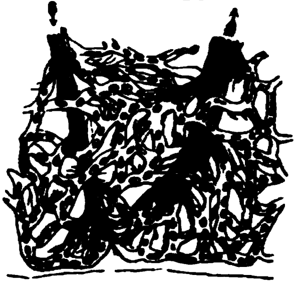


Fig. 4.

But I must end my lecture; and as it has been dull and prosaic, let me adorn it with those lines from Dr. Oliver Wendell Holmes' poem, "The Anatomist's Hymn," which describe the blood—

"Whose streams of brightening purple rush,
Fired with a new and livelier blush,
And red with Nature's flame they start
From the warm fountain of the heart.

"No rest that throbbing slave may ask,
For ever quivering o'er his task,
While far and wide a crimson jet
Leaps forth to fill the woven net,
Which, in unnumber'd crossing tides,
The flood of burning life divides,
Then, kindling each decaying part,
Creeps back to find the throbbing heart."

The last verse expresses an aspiration which cannot fail to recur daily to the mind of the Christian anatomist:—

"O, Father. grant Thy love, divine,
To make these mystic temples Thine,

When wasting age and wearying strife
Have sapp'd the leaning walls of life;
When darkness gathers over all.
And the last tottering pillars fall,
Take the poor dust Thy mercy warms,
And mould it into heavenly forms."

XXIX.—*Meteoric Showers*. By G. JOHNSTONE STONEY, M. A., F. R. S., being the substance of a Lecture delivered on April 3, 1869.

METEORS AS THEY APPEAR IN THE EARTH'S ATMOSPHERE.

WHEN observers band together to watch every quarter of the sky, and to keep on the look-out through the whole night, the number of meteors that present themselves is very great. In this way it has been ascertained that upwards of thirty on the average, which are conspicuous enough to be seen without instruments, come within the view of the observers stationed at one locality. And it is computed that telescopic meteors must be about forty or fifty times as numerous as those visible to the naked eye.

These results may be obtained from observations made at one station; but when concerted observations are carried on at different stations, several other facts of interest come to light. By simultaneous observations at distant stations, it has been discovered that the height of meteors above the surface of the earth usually ranges from 120 down to twenty miles, the average height being about sixty miles; that the direction of their flight is towards the earth, either in a vertical or in a sloping direction; and that their speed in most cases lies between thirty and fifty miles a second.

We thus arrive at the conclusion that *visible* meteors are phenomena of our own atmosphere; and as the atmosphere reaches a height, at most, of 150 miles, and is, therefore, but a thin film over so vast a globe as the earth, it is obvious that the spectators at any one place can see only a very small portion of the meteors which dart about through all parts of this envelope. After making allowance for this, we are forced to conclude that no fewer than 300 millions of these bodies pass daily into the earth's atmosphere, of which about seven millions and a half are large enough to be seen with the naked eye on a clear night, and in the absence of the moon.

From the direction and swiftness of their flight, it is manifest that meteors are visitors from without. They plunge into our atmosphere, and the resistance to which they become then suddenly exposed must raise them to a temperature which exceeds that of the most intense furnace. The heat is enough first to melt and then to dissipate in vapour the most refractory substances, and it only now and then happens that even a part of a meteor escapes this fate, and reaches the ground. They are for the most part dissipated in vapour ere they get within several miles of us. The difficulty, indeed, is not to account for their incandescence, but to see why they do not emit a greater flood of light where the heat must be so intense. And, in fact, they cannot be other than very small bodies, or they would be much brighter. The average weight of those visible to the unassisted eye appears to be under an ounce, and the telescopic ones, of course, are much lighter.

SPORADIC METEORS, AND METEORIC SHOWERS.

Meteors may be distributed into two very obvious classes—casual meteors, which dart irregularly through the sky, and meteoric showers, which stream into our atmosphere in one definite direction, and at stated intervals of time. We are concerned at present with the meteoric showers. Many such are known to exist, of which the principal are the August shower, through which the earth passes every year upon the 9th, 10th, and 11th of August; and the great November shower, which is discharged upon the earth three times in a century. The November meteors are those about which most is known, and it was of these, therefore, that the lecture chiefly treated.

THE REGIONS FROM WHICH METEORS COME.

To make their history intelligible, it was necessary to explore, in some degree, the regions from which they come. For this purpose a great diagram was exhibited on a scale rather more than thirty times the scale of the accompanying woodcut. Yet, though the diagram was so large, every hundredth of an inch upon it represented a distance in nature equal to the interval between the earth and the moon. The distance from the earth to the sun on this diagram was a decimeter, that is, four inches; and, on the same scale, the nearest fixed star would have to be placed at a distance of twenty kilometers, or upwards of twelve miles.

ORBIT OF THE GREAT NOVEMBER SWARM.

In these vast celestial spaces, there are no rails over the roughnesses of which the train must be made to rattle, if it is to move at all; there is no air in which a wind must be produced; there are no wheels to be worn out. The music of the spheres is not a sound audible to the ear, and an impediment to motion: it is harmless, it is altogether good, it is the pleasure of the human mind when it understands the great works of nature. There is no thundering along through the heavens. All is silence and peace around the planets as they swiftly glide. Bodies which sweep in this way without obstruction through the depths of space, are ready to yield at once the due amount of obedience to the attraction of the sun. Accordingly each meteor which traverses the elliptic orbit represented in the diagram, mends its pace so long as it is gliding along that half of its course in which it is approaching the sun, because here the sun is drawing it forwards as well as sideways; and the forward attraction increases its velocity, while the sideward attraction bends its path into the oval form. The meteor takes upwards of sixteen years to traverse this part of its orbit, and all this time its velocity is on the increase. It has attained its greatest speed when it reaches the point of its orbit which is closest to the sun, near to which is the place where it crosses the earth's path. As it passes this point its velocity is twenty-seven miles a second. The earth moves at the rate of nineteen miles a second in very nearly the opposite direction, so that if the meteor happens to strike the earth, the velocity of its approach is the sum of these two numbers, or forty-six miles a second; and it is at this enormous speed that it plunges into our atmosphere. But if it escape the earth, and continues its course along its orbit, it loses speed for the next sixteen years, until it passes the farthest part of its orbit at its slowest pace, which is about a mile and a third per second. In each revolution its velocity oscillates between these extremes. Its orbit is so vast that it takes thirty-three years and a quarter to get round it.

Such is a good picture of the course pursued by each member of the great November swarm. There are countless myriads of meteors in this mighty group, each one moving independently of the rest, each one fulfilling its own destiny. They form, together, an enormous stream of meteors, which appears to be about 100,000 miles in width, and of immense length. The orbit along which they travel was represented on the diagram by an ellipse of 207 centimeters, or close upon seven feet, long; and the present length, breadth, position, and motion of the swarm would be represented on the same scale by a thread of the finest sewing silk, about a foot and a half or two feet long, creeping outwards along the orbit, the front of the column being at present between the orbits of Jupiter and Saturn, and the rear of it nearly as far in as the earth's orbit. The actual train which is thus represented is so amazingly long that even moving at the rate of twenty-seven miles a second, it takes upwards of two years to pass the point where its path crosses the earth's orbit. The earth passes this point on the morning of the 14th of November in every year. The head of the stream seems to have reached it early in the year 1866. The earth was then in a distant part of its orbit, but on the following 14th of November we came round to the place where a dense part of the stream of meteors was pouring across our path. The earth then passed through the stream, just as you might imagine a speck, too small to be seen by the eye, to be carried on the point of a fine needle in a sloping direction through the thread which represents the meteors. The earth took about five hours to pass through the stream; and it was Europe, Asia, and Africa, which happened at the time to be moving forwards. Accordingly it was upon this side of the earth on that occasion, that the meteors were poured, and they produced the gorgeous display in our atmosphere which we all remember. In 1867, when we came round again to the same place, the stream of meteors was still there. America, this time, chanced to be the part of the globe which was turned in the right position to receive the shower. Even in 1868, the mighty stream had not entirely passed, and this year, when we come round a fourth time to the proper place, we may perhaps find ourselves among the hindermost stragglers of the great procession.

The lecturer next attempted to give an outline of the successive steps by which all this had been learned, and in doing so had an opportunity of adding other particulars to the marvellous history of these bodies.

HUMBOLDT.

In 1779 Humboldt was travelling in South America, and on the morning of the 12th of November in that year the November shower was poured out over the New World. Humboldt's description of this shower seems first to have fixed the attention of scientific men upon the subject. But he contributed still more to the advance of our knowledge by the success with which he insisted that nearly all such phenomena are periodic, and that therefore there is reason to hope that the causes of them are discoverable. Shortly after, the periodic character of the August meteors was established, and when the next return of the November meteors to the earth took place, when there was a magnificent display of them exhibited to Europe in 1832, and a still more impressive spectacle seen in America in the following year, the attention of scientific men was thoroughly aroused.

PROFESSOR H. A. NEWTON.

In England, meteors began to be systematically observed, and in this way all that knowledge about them has been acquired which was referred to in the beginning of the lecture. In France, the records of antiquity and the annals of distant nations were ransacked; and by this most useful antiquarian search, no less than ten visits of the November swarm, previous to the shower observed by Humboldt in 1799, have been brought to light. But the first great step towards gaining a knowledge of their orbit was made by Professor H. Newton, of New Haven in America, who published in 1864 two memoirs in which he discussed all the accounts that had been collected, extending back to the year A. D. 902. He found by comparing the dates of the old observations with the modern ones, that the phenomenon is one which recurs three times in a century, or more exactly, that the middle of the swarm crosses the earth's path at intervals of 33¼ years. He further showed that meteors which thus visit the earth three times in a century must be moving in one or other of five orbits which he described;

and that therefore if means could be found for deciding between these five orbits, the problem would be solved. The five possible orbits are —the great oval orbit which we now know the meteors actually do traverse every 33 years and a quarter; a nearly circular orbit, very little larger than the earth's orbit, which they would move round in a few days more than a year; another similar orbit in which their periodic time would be a few days short of a year, and two other small oval orbits lying within the earth's orbit. But we owe even more to Professor Newton. He also pointed out how it was *possible* to ascertain which of these orbits is the true one, although the test he indicated was one so difficult of application that there was at the time little hope that any astronomer would attempt it. Fortunately our own Professor Adams, of Cambridge, was found able to grapple with the difficulties of the problem, and willing to encounter its immense labour, and to him we owe the completion of this great discovery.

PROFESSOR ADAMS.

A comparison of the dates of the successive showers which have been recorded shows that the point where the path of the meteors crosses the earth's orbit is not fixed, but that every time the meteors come round they strike the earth's orbit at a point which is twenty-nine minutes (*i. e.*, nearly half a degree) farther on in the direction in which the earth is travelling. In other words, the meteors do not describe exactly the same orbit over and over again: their path in one revolution is not exactly the same as their path in the next revolution, although very close to it. Thus, their path in A. D. 126 was that which is represented by the strong oval line in the diagram, but in the seventeen centuries which had since elapsed, it has gradually shifted round into the position represented by the dotted ellipse. This kind of motion is well known to astronomers, and its cause is well known. It would not happen if the sun were the only body attracting the meteors, but arises because the planets also draw them in other directions; and although the attraction of the planets is very weak compared with the immense power of the sun, still they are able to drag the meteors a little out of their course round the sun, and in this way occasion that shifting round of the orbit of which we are speaking. Now, in the case of meteors which are really travelling in the large orbit, this shifting of the orbit must be due to the attraction of the planets, Jupiter, Saturn, Uranus, and the Earth, while if they had travelled in any of the four smaller orbits, the planets that would be near enough and large enough to act sensibly upon them would be the Earth, Venus, and Jupiter. Accordingly, if any one could be found able to calculate how much effect would be produced in each of the five cases, the calculated amount of shifting of the orbit could be compared with the observed amount, which is 29′ in 33¼ years, and this would at once tell which of the five possible orbits is the true one.

These papers of Professor Newton's were published in 1864. Before the computations which he had indicated could be attempted, it was necessary that the direction in which the meteors enter the earth's atmosphere should be known much more accurately than it then was. For this would enable the exact forms and positions of the five possible orbits to be ascertained. This observation then was of the greatest importance in 1866, and it was on this account that all the astronomers on that occasion devoted nearly all their efforts to determining with the utmost precision the exact point of the constellation Leo from which the meteors seemed to radiate. This important direction was ascertained during the great meteoric shower on the morning of the 14th of Nov., 1866, and immediately after Professor Adams and his two assistants in the Cambridge Observatory set to work at their arduous task. I could not attempt to carry you through the most meagre outline of the steps of this great computation. It required the solution of a problem in mechanics which had never before been attempted, and involved an immense amount of tedious labour. Amidst all these difficulties Professor Adams triumphed, and after months of toil he was able to announce in the following March that if the meteors are moving in the large orbit, Jupiter would produce a shifting of the orbit in each revolution amounting to 20′, the attraction of Saturn would add to this 7′, Uranus would add 1′; the effect of the earth and the other planets would be insensible. Adding these numbers together, the whole effect, according to Mr. Adams's computation, is 28′, almost exactly the same as the observed amount which had been determined by Professor Newton, which was 29′. But if the meteors were in any of the other four possible orbits, the total amount would never exceed 12′. Here, then, we have reached the final result: the long orbit is the orbit of the meteors. This great discovery was published in March, 1867.

PROFESSOR SCHIAPPARELLI.

Meanwhile Signor Schiapparelli, of Milan, was labouring in another direction. It was evident from the observations that the meteors were drawn out into a long stream. What was the cause of this? Signor Schiapparelli pointed out that if a cloud of meteors were started under conditions which were not quite the same, each meteor would pursue its own orbit, which would differ from the others. If they were treated almost exactly, although not quite, alike at starting, their various orbits would lie excessively close to one another, and would be undistinguishable in most respects. But if there be any effect which goes on accumulating from revolution to revolution, such an effect would in the end become very sensible. And such an effect there is. The periodic times differ a little in these different orbits. At the end of the first revolution those meteors which have the longest periodic times are the last to get back to the starting point, and have therefore already fallen a little into the rear of the group, while those with the shortest periodic time have gone a little a-head. At the end of the second revolution the separation is doubled, and in each successive revolution the column is still more lengthened out. After a sufficient number of revolutions it will be spread out over the whole length of the orbit, and form a complete oval ring. This has not yet happened to the November meteors, and we are thus assured that it cannot be any enormous period, speaking cosmically, since the time when they first started on their present path. On the other hand the August meteors, which have returned punctually *every* year since they were first observed, are probably a complete ring, and are at all events of far greater antiquity than the November meteors. But they are also, as might be expected, more scattered, so that the sprinkling of meteors they discharge upon the earth as it passes through them has nothing like the splendour of the great November shower. Signor Schiapparelli also pointed out that there is a comet moving in the track of the August meteors, and another in the track of the November meteors. We shall presently see the significance of this observation.

M. LE VERRIER.

The next great step was made by M. Le Verrier, the Director of the Paris Observatory. Acting on the suggestion made by Sig. Schiapparelli, M. Le Verrier pointed out that the orbit of the meteors intersects the orbit of Uranus, as represented in the diagram. From its inclined position it does not intersect the path of any of the intermediate planets, Saturn, Jupiter, and Mars. M. Le Verrier also calculated back the epochs at which the planet and the meteors were at the point of intersection, and found that early in the year A. D. 126, they were both at that spot, but that this has not happened since. Taking this in conjunction with what Sig. Schiapparelli pointed out, we seem to have a clue to a truly wonderful past history. All would be explained if we may suppose that before the year 126, the meteors had been moving beyond the solar system; and that in that year they chanced to cross the path of the planet Uranus, travelling along some such path as that represented in the diagram. Had it not been for the planet they would have kept on the course marked out with a dotted line, and after having passed the sun, would have withdrawn on the other side into the depths of space, to the same measureless distance from which they had originally come. But their stumbling on the planet changed their whole destiny. Even so great a planet would not sensibly affect them until they got within a distance, which would look very short indeed upon our diagram. But they seem to have almost grazed his surface, and while they were very close to such a planet, he would be able to drag them quite out of their former course. This the planet Uranus seems to have done, and when, pursuing his own course, he again got too far off to influence them sensibly, they found themselves moving slowly backwards, and slowly inwards; and accordingly began the new orbit round the sun, which corresponds to the situation into which they had been brought, and the direction and moderate speed of their new motion.

They seem to have passed Uranus while they were still a small compact cluster. Nevertheless those members of the group which happened to be next the planet as they swept past, would be attracted with somewhat more force than the rest, the farthest members of the group with the least. The result of this must inevitably have been that when the group were soon after abandoned to themselves, they did not find themselves so closely compacted as before, nor moving with an absolutely identical motion, but with motions which differed, although perhaps very little, from one another. These are conditions which would have started them in those slightly differing orbits round the sun, which, as we have seen, would cause them, as time wore on, to be drawn out into the long stream in which we now, after seventeen centuries, find them.

MR. STONEY.

One other episode in the eventful history of these meteors is also known with considerable probability. It has been already mentioned that a comet is travelling along the same path as the meteors. It is moving a very little slower than they, and is at present just at the head of the procession which they make through space. Another comet is similarly moving in the track of the great elliptic ring of August meteors. In 1867, the Lecturer ventured to suggest the important function which these comets seem to have discharged. Picture to yourselves such a comet before it became connected with the solar system, travelling through space at a distance from the sun or any other star. Meteors would now and then pass in various directions, and with various velocities through its substance. For the most part they would go entirely through and pass out again; but in every such case the meteor would leave the comet with less velocity than it had when approaching it. And in some cases this reduced velocity would be such that the future path of the meteor would be an ellipse round the comet. Whenever this was once brought to pass, the meteor would inevitably return again and again to the comet, each time passing through some part of its substance, and at every passage losing speed. After each loss of speed the ellipse it would next proceed to describe would be smaller than the one before, until at last the meteor would sink entirely into the comet, and be engulfed by it. In this way meteor after meteor would settle down through the comet, and, in the end, just such a cluster would be formed as came across the planet Uranus in the year 126. As they swept past the planet, the outlying parts of the comet would seem to have grazed his surface, and in this way the comet was probably somewhat more retarded than the meteors; and in the centuries which have since elapsed the meteors have gone so much ahead of the comet that they are now treading on his heels and on the point of overtaking him.

RECAPITULATION.

We have now traced an outline of the marvellous history of these Arabs of the sky. We have found a comet wandering through boundless space, with nothing near it except an occasional solitary meteor. We have seen it in the long lapse of ages slowly gathering together a cluster of these little strangers. In its travels it passes within the far-spreading reach of the sun's attraction, and perhaps has since been millions of years in descending towards him. Its natural course would have been to have glided round him in a curve, and to have then withdrawn to the same vast abyss from which it had come; but in attempting this, it became entangled with one of the planets, which dragged it out of its course and then flung it aside. Immediately, it entered upon the new course assigned to it, which it has been pursuing ever since. After passing the planet the different members of the group found themselves in paths very close to one another, but not absolutely the same. These orbits differed from one another very slightly in all respects, and amongst others in the time which a body takes to travel round them. Those meteors which got round soonest, found themselves, after the first revolution, at the head of the group; those which moved slowest fell into the rere, and the comet was the last of all. Each succeeding revolution lengthened out the column, and the comet soon separated from the rest. Fifty-two revolutions have now taken place, and the little cloud has crept out into an extended stream, stretching a long way round the orbit, while the comet has fallen the greater part of a revolution behind. We can look forward too, and see that in seventeen centuries more the train will have doubled its length, and that ultimately it will form a complete ring round the whole orbit. When this takes place, a shower of these meteors will fall every year upon the earth, but the swarm will be then so scattered that the display will be far less imposing than it now is.

Such is the history of one of the many meteoric streams which cross the path of the earth. There are several of these streams, and no doubt the story of every one of them is quite as strange. And if there are several streams of meteors, which come across that little line in space which constitutes the earth's orbit, what untold multitudes of them must be within the whole length and breadth of the solar system! Perhaps it may even turn out that the mysterious zodiacal light which attends the sun, is due to countless hordes of these little bodies flying in all directions through the space that lies within the earth's orbit.

POSTSCRIPT.

Professor Newton's Memoirs will be found in Silliman's Journal for 1864, Vol. XXXVII., p. 377; and Vol. XXXVIII., p. 53.

The result of Professor Adams's investigations was announced in the Comptes Rendus of the Academy of Sciences of Paris, of the 25th March, 1867, p. 651; and a fuller account of it will be found in the Monthly Notices of the Astronomical Society for April, 1867, p. 247.

An account of Sig. Schiapparelli's contributions will be found in Les Mondes for December, 1866; and the first quarter of 1867. An outline of them in English, from the pen of Professor Newton, will be found in the Philosophical Magazine for July, 1867, p. 34.

M. Le Verrier's communication was made to the French Academy of Sciences, and is published in the "Comte Rendu" of the 21st January, 1867, p. 94.

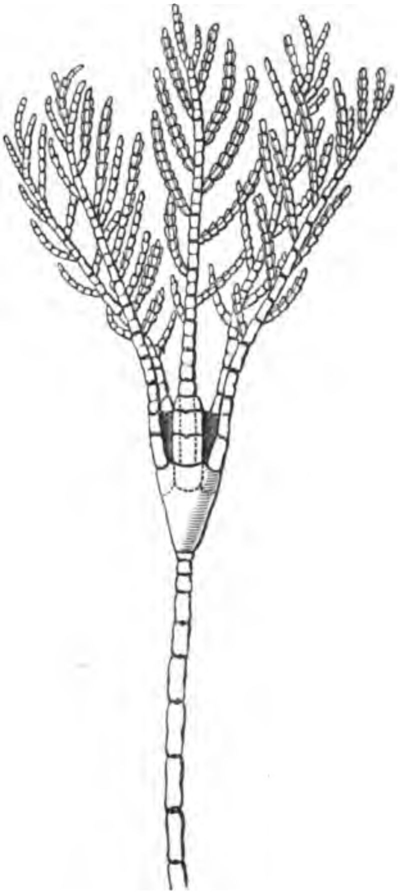
Mr. Stoney's paper will be found in the Monthly Notices of the Astronomical Society for June, 1867, p. 271; and in the Philosophical Magazine for September, 1867, p. 188.

XXX.—*On the Depths of the Sea.* By PROFESSOR WYVILLE THOMSON, LL. D., F. R. S. E., F. G. S., being the substance of a Lecture delivered on the 10th of April, 1869.

IN the year 1864, and in succeeding years, G. O. Sars, a distinguished son of the veteran and very distinguished Professor of Zoology in the University of Christiania, was employed as a Commissioner of Fisheries in the service of the Swedish Government; and in his official capacity he had an opportunity of dredging in deep water (300 fathoms) off the Loffoten Islands, within the Arctic Circle. Instead of finding the bottom of the sea barren at these great depths, as many circumstances had led many of our most able naturalists to anticipate; he brought up a multitude of animal forms, all of them of the highest interest both from their biological and their geological relations; and many were new to science.

One animal form, of which about seventy specimens were found, was of surpassing interest. It was a "Crinoid"—a stalked starfish, with a delicate threadlike stem three or four inches long, and a head at first sight very closely resembling that of the pentacrinoid larval stage of a feather-star which is common in deep water off the Norwegian coast. A careful examination, however, showed that the crinoid was mature, and that it belonged to a totally distinct family of the order, hitherto only known fossil, and supposed to be almost entirely confined to the Mezozoic series of beds. This family is called the Apiocrinidæ, from the characteristic genus Apiocrinus, of which the species best known in this country is the "pear encrinite," which was got in great abundance in a bed of Great Oolite, exposed in cutting the tunnel through Box Hill. The group seems to have attained its maximum during the period of the deposition of the oolitic beds in the European area. It is not represented in the earlier formations, but we find handsome, well-developed species belonging to several genera in the Jurassic beds on the Continent. In the lower beds of the chalk there are two or three somewhat obscure forms, while in the white chalk the family, so far as we know, is represented by a single species of a single genus, Bourgueticrinus ellipticus, in which the head and arms are greatly reduced in size and development, the stem is much branched, and its joints are indefinitely and irregularly multiplied; which shows, in fact, all those peculiarities which we are accustomed to associate with comparative degradation in the animal scale. In the Tertiary formations there are only some obscure traces of one or two small forms of the group. Rhizocrinus Loffotensis of Sars stands in nearly the same relation to the Bourgueticrinus of the English chalk, in which Bourgueticrinus stands to the Apiocrinites and Millericrinites of the Oolite. It is much smaller; the stem is even larger in proportion to the cup and special organs of nutrition; and here alone among known Crinoids we meet with a character which would indicate marked degradation—an irregularity in the number of the arms, of which there are sometimes four, sometimes five, and sometimes even six. It looks like a Bourgueticrinus which had been going to the bad for a million of ages; which was somehow getting worsted in the "struggle for life."

Fig. 1.



Rhizocrinus Loffotensis (Sars.)
(Four times the natural size.)

Rhizocrinus seems to be very generally distributed; Dr. Carpenter and I dredged it last summer off the north of Scotland, and about the same time Count Pourtales, who was investigating the opposite border of the Gulf Stream in connexion with the American Coast Survey, found it off the reefs of Florida.

Two living stalked Crinoids are well known inhabiting deep water in the sea of the Antilles, and apparently some other localities in the

Indian and Australian seas; but they belong to a parallel family, which has come down continuously, usually represented by only a few species, from the period of the deposition of the English Lias. The remarkable point is the discovery of a representative, living at great depths in modern seas, of a family which had dwindled away, and apparently become almost extinct before the formation of the older Tertiaries. No discovery in natural science so suggestive as that of young Sars had been made for many long years; it set many of us pondering on the distribution and conditions of life in the depths of the sea.

The questions involved are very complicated. The late Professor Edward Forbes was the great authority on the distribution of marine life; he and his friend the late Dr. Robert Ball initiated the use of the dredge, and Forbes defined certain zones of depth which he held to be inhabited by special and characteristic groups of animals. The last of these was the abyssal or deep-sea zone, and he supposed that in this zone, which extended downwards from the 100-fathom line, life gradually became more and more scarce, till, at a depth of about 300 fathoms, it altogether ceased. Forbes' experience was much wider than that of any other naturalist of his time; the practical difficulties in the way of testing his conclusions were great, and they were accepted generally by naturalists without question. There was, besides, a popular impression that the conditions a mile beneath the surface of the sea must be so very peculiar, as to make it difficult to conceive that animals, more or less nearly related to forms inhabiting the upper world, could exist there; accordingly no attempt was made to dredge at great depths, except on the Scandinavian coast, and the results of the scattered observations made there have only appeared within the last few years. Except in one or two cases which never became very generally known, all the few creatures which came up to protest against Forbes' theory, came clinging to sounding lines, and were valueless for absolute proof; as their mode of capture constantly involved the question, which at that time we were unable to answer, whether there might not be pelagic forms of the groups to which they belonged.

In the year 1860 H. M. S. "Bulldog" sounded over the Atlantic plateau, and shortly after her return Dr. Wallich, the surgeon-naturalist who accompanied her, published a warm and able defence of the bottom of the sea as an inhabited region. The evidence of the existence of highly organized forms at great depths was not even yet however quite conclusive, as it still depended on star-fishes clinging to lead-lines, and although, from want of data, the subject was little discussed, the feeling of naturalists seemed still to be in favour of Forbes' "Zero of Animal Life."

THE CRUISE OF THE "LIGHTNING."

About the time of Sars' explorations in Loffoten, my friend Dr. Carpenter and I were engaged in some investigations which made the discovery of Rhizocrinus especially interesting to us, and we talked over, again and again, the curious questions, both geological and biological, which Sars' dredgings suggested. We finally arranged that I should write a letter to Dr. Carpenter, who was then Vice-President of the Royal Society, sketching out what I conceived to be a promising line of inquiry, indicating generally the results which I anticipated, and urging him to endeavour to induce the Council of the Royal Society to apply to the Admiralty for a vessel fitted with dredging gear, that among other questions, the question of deep-sea life might if possible be settled definitely; by bringing up a quantity of the bottom, with its inhabitants, if there were any, along with it. The Council of the Royal Society acceded to Dr. Carpenter's request, and the Admiralty most liberally placed the surveying gunboat "Lightning" at their disposal, under the able and genial command of Staff Commander May. On the 11th of August last Dr. Carpenter and I left Stornoway, and steamed northwards towards the Faroe Islands. We had shocking weather—indeed during the whole of the cruise, which lasted nearly six weeks, we could only use the dredge on nine days, and only on four in deep water. We dredged a little on the Faroe banks, with small results, and on the 17th of August we reached Thorshaven, the capital of the Faroe Islands. We spent several days exploring the Fjords of that hospitable but hazy land, where it seems never to be afternoon, but always grey misty morning or night. On the 26th we left Thorshaven, and were driven by dirty weather to the south-eastward. This was perhaps fortunate, for it forced us to examine more carefully than we might otherwise have done the "cold area," to be mentioned hereafter, where the bottom was of stones and coarse sand, where the thermometer registered a minimum of 32° F., and where the fauna consisted of a meagre sprinkling of boreal and arctic forms. On the 4th of September we dredged in 530 fathoms, the thermometers registering a minimum of 47·5° F., and brought up a mass of fine, grey, slimy mud, technically called "ooze;" but which I shall now called "chalk-mud." We traced the area having this high temperature, which we may call the "gulf-stream area," southwards and westwards, in a line between the plateau of the Faroes and the north coast of Scotland, and Dr. Carpenter afterwards followed it as far north as lat. 61°. It is to this area and its geological and biological relations, that I wish specially to direct your attention.

CHALK-MUD AND CHALK.

During the last twenty or thirty years, very great improvements have been made in sounding apparatus, so that depths can now, as a general rule, be ascertained with a tolerable amount of precision. By two or three very ingenious contrivances, cups-ful, or little buckets-ful of the bottom may be brought up by the sounding line; one of these, contrived by Lieutenant Fitzgerald, R. N., which we used in the "Lightning," is exceedingly clever; I never knew it to fail. The laying of the cable directed special attention to the sounding of the North Atlantic; and in 1857, Captain Dayman; and in 1860, Sir Leopold M'Clintock accompanied by Dr. Wallich; and afterwards several others, sounded the area, and brought home what specimens of the bottom they could procure. The result of the sounding was the definition of the great Telegraph plateau, stretching from Valentia nearly to Newfoundland, with an average depth of 2000 fathoms, with greatly deeper depths extending southwards towards the Azores. The result of the examination of the soundings was, that the bottom in all cases consisted of a fine calcareous mud; of countless myriads of the shells of a Rhizopod, Globigerina; and of some very peculiar bodies, which have been called Coccoliths and Coccospheres. In the meantime, naturalists were examining the microscopic structure of the white chalk, and they found it to consist of fine calcareous particles, Globigerinae and other foraminifera, and Coccoliths and Coccospheres. The structure of the chalk was, in fact, identical with that of the chalk-mud of the Atlantic. One might have thought that these deep sea soundings should have settled the question of the existence of life in the depths of the ocean, but they were all open to the objection that the Globigerinae and other organisms could not be shown to be absolutely living, and it was conceivable that they might have lived nearer the surface, and have sunk to the bottom after death.

All over the "warm area," our dredge brought up little else than the globigerina mud; not now, however, pure. The dredge brought up about a hundred weight at a haul. On one occasion a little way to the south of the Faroes, it brought up, mixed with the mud, about forty sponges—living—with the delicate and exquisitely-formed spicules suspended in the transparent sarcode. Most of these sponges had long and venerable beards of flint, spreading in all directions through the chalk-mud. These beards brought up, entangled in them, small clams, starfishes, and minute crustaceans; and among the mud were scattered the shells of the beautiful and well-known Pteropods of the Gulf Stream.

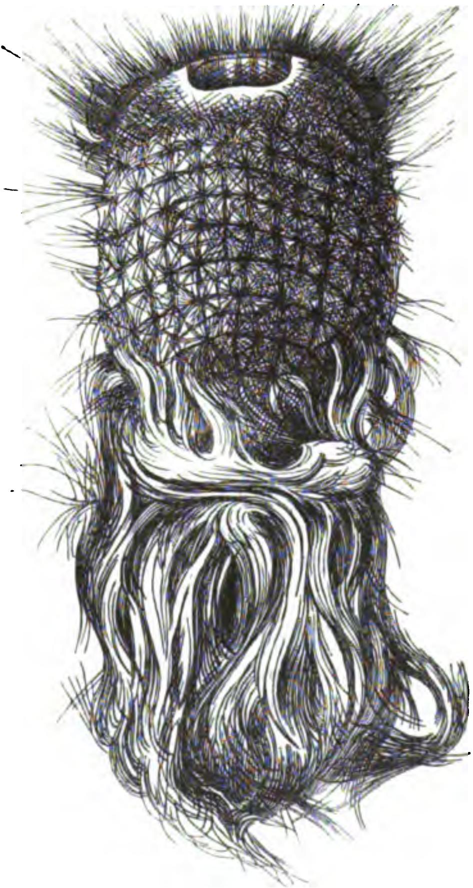
There can be no doubt whatever—indeed it is admitted by all microscopists—that chalk is now being formed in the depths of the Atlantic; but an idea which suggested itself to us even before we proposed our cruise has now ripened into a conviction, that it is not only chalk which is being formed, but THE CHALK—the chalk of the Cretaceous Period. There is one abyss in the Atlantic, in which the Himalaya mountains might lie, with the waves rolling over them unbroken; and there is no direct evidence that oscillations have taken place in the north of Europe or in North America, since the deposition of the earlier tertiaries, beyond 1500 feet; in fact there is a very strong presumption that the main features of the contour of the crust of the earth have altered but little since the commencement of the Mezozoic period, and that the great depressions, the Atlantic, the Pacific, and the Antarctic Oceans, are due to causes which acted even before that very remote epoch. There have been constant minor oscillations; but the beds formed during the periods of depression, and now exposed by an upheaval of this minor character; are all comparatively local and shallow-water beds, as shown by the nature and the richness of their faunae. To put this in another form; there is no reason to suppose that either the physical or the biological conditions of two-thirds of the ocean have been affected by the oscillations which produced the varying distribution of the sea and land, and the local modifications and migrations of faunae during the Tertiary period. No doubt the temperature of the different portions of the deep sea has altered again and again, owing to geographical changes influencing the distribution of the minor currents and the branches of the great currents; and it is to the accumulation of these slight changes through countless ages that we must look as the cause of the gradual modification of the fauna of the chalk; of the extinction of some animal groups, and the greater development of others. A bit of the edge of the Cretaceous formation has been tilted up, to form the white cliffs of Albion and the chalk beds of France; but the great mass of the formation maintains nearly the same character, and is now entombing the same groups of organisms, among the Philippines, off the coast of Spain, in the seas of Japan, near the coast of Massachusetts, off the Faroes, and to the extreme Loffoten Islands. I imagine that this is one of the GREAT FORMATIONS,—one of the corner stones in the building of the earth; formed slowly in vast areas of subsidence; which will only make its appearance in mass along with a complete change in the distribution of land and sea; and which may be expected in some places to resist denudation, and to stand like the mountain limestone, as one of the odd pages of a future geological record. Some great peculiarities in the distribution of the miocence land-flora have led to the idea that one of these minor oscillations may have depressed the "Telegraph Plateau" during later Tertiary times. It may be so, though I think the evidence is very unsatisfactory; but it is by no means necessary that every part of the present Cretaceous basin should have been sea throughout; whenever it was sea, however, it was continuous in space with a sea which had been continuous in time—probably, at all events, from the commencement of the Jurassic period; and was peopled from that sea. If these views prove correct, they must modify considerably our interpretation of geological history.

CHALK FLINTS.

There is one point, in the structure and composition of the white chalk, which distinguishes it, in the most marked way, from the modern deposits of the Atlantic. Modern soundings and dredgings from all depths, are full of delicate siliceous organisms of the most varied and beautiful forms. Shields of diatoms, spicules of sponges, and the wonderful netted skeletons of the polycystina. The soft calcareous mud is the home of multitudes of exquisitely-formed glassy and other siliceous sponges; the chalk, on the other hand, may be said to contain no disseminated silica whatever. When chalk is dissolved in acid, a few grains or crystalline fragments of silica remain; but these are apparently all of inorganic origin—fragments of mineral matter. Instead, however, of disseminated siliceous organisms, we have, in the chalk, bands and lines of flints; lumps of amorphous silica, which seem to have filled up and taken the shape of any cavities already existing in the beds. Many of these flints are apparently quite shapeless, but many of them, such as the so-called "paramondras" of the Antrim chalk, have, more or less distinctly, the form of large cup-like sponges. Often the shell of a sea-urchin forms the mould of a flint, which fills it entirely, reproducing in relief on its external surface every suture and perforation of the inner surface of the shell. The conclusion seems to be irresistible, that in some way, which we do not as yet thoroughly understand, but to which some late observations of the Master of the Mint seem to promise a clue, the organic silica, if I may use the expression, is dissolved out of the calcareous matrix; the solution percolates into and through the cavities, the water being gradually drained from the silica, which is in the colloid state, by the walls of the cavities acting as porous media; till, on the water being nearly or entirely removed, the silica "sets" into flint. In the white chalk of England there is an exceedingly beautiful group of fossils, called Ventriculites, which have greatly puzzled paleontologists. They have usually the form of graceful vases, tubes, or funnels; variously ridged or grooved, or otherwise ornamented on the surface; frequently expanded above into a cup-like lip, and continued below into a bundle of fibrous roots. The minute structure of these bodies shows an extremely delicate tracery of fine tubes, sometimes empty, sometimes filled with loose calcareous matter, dyed with per-oxide of iron. We have been in the habit of regarding the ventriculites as an extinct group, specially characteristic of the chalk; but after examining several species, and studying carefully Mr. Toulmin Smith's excellent observations on their structure, I now thoroughly believe that they were siliceous sponges, nearly allied to, if not identical with, the recent order, PORIFERA VITREA; and that the silica of their spicules was removed, and went to add to the jelly-like material of the flints, leaving the moulds only in the chalk. Ventriculites are not extremely common in the white chalk, nor are they very large; and so far from being extinct, my belief is that the group has attained probably a much higher development in our times; that while the pear-encrinites have been losing ground, the ventriculites have been gaining it. One haul of our dredge in the soft, warm, oozy, chalk-mud off the north of Scotland, brought up from a depth of 500 fathoms upwards of forty specimens of vitreous sponges. Many of these were new to science, and some of them resembled closely the beautiful Venus' flower-basket of the Philippines, while among them were probably two species of Hyalonema, the strange glass-rope sponge of Japan. Four specimens of this wonderful new form of vitreous sponge, which I exhibit (see woodcut), were brought up in this haul. They were loaded with their glairy sarcode, and had evidently been buried in the ooze nearly to the lip. When one looks at the exquisite symmetry of these organisms, one almost wonders at the recklessness of beauty, which produces such structures to live and die for ever invisible, in the mud and darkness of the abysses of the sea. I dedicate, with great pleasure, the new genus to which this sponge must be referred, to our kind and hospitable friend, his Excellency M. Holten, the Governor of the Faroe Islands, who showed the greatest interest in the success of our expedition, and on the verge of whose dominions it was found. I dedicate the species to my colleague, Dr. Carpenter.

The mud was entirely filled with the delicate siliceous root fibres of the vitreous sponges, binding it together, and traversing it in all directions like hairs in mortar. This mud was actually alive; it stuck together in lumps, as if there were white of egg mixed with it, and the glairy mass proved, under the microscope, to be living sarcode. Prof. Huxley regards this as a distinct creature, and calls it "Bathybius." I think this requires confirmation. Every fibre and spicule of each sponge has its own special sheath of sarcode, and the glairy matter in the mud may, I think, be simply a sort of diffused mycelium of the different distinct sponges. This view accords well, I believe, with the mode of nutrition of the sponges.

Fig 2.



HOLTENIA CARPENTERI (WY. T.)
(Half the natural size.)

THE CONDITIONS OF THE DEPTHS.—PRESSURE.

The conditions which might be expected to affect animal life at great depths in the ocean are pressure; temperature; and the absence of light, involving apparently the absence of vegetable food. The conditions of pressure are certainly very peculiar. A man at the depth of a mile would bear upon his body a weight equal to about ten ordinary goods trains, engines and all, loaded with pig iron. We are apt to forget, however, that water is nearly incompressible, and that, therefore, the sea water at the depth of a mile has scarcely an appreciably greater density than it has at the surface. At the depth of a mile, under a pressure of 159 atmospheres, sea water, according to the formula given by Jamin, is compressed by the $\frac{1}{144}$ of its volume; and at 20 miles, supposing the law of the compressibility of water to continue the same, by only $\frac{1}{7}$ of its volume—that is to say, the volume at that depth will be still $\frac{6}{7}$ of the volume of the same weight of water at the surface. Substances, also, permeated and uniformly supported within and without by the water, are, so far as their physical conditions, freedom of motion, &c., are concerned, in no way affected by the pressure. We sometimes rise in the morning, and find from a fall of an inch in the barometer, that we have been gradually and quietly relieved during the night of half a ton weight; yet we feel it only by a slight lassitude, from its requiring rather more muscular exertion to move our bodies in the rarer medium. There is no reason to believe that water contains less air at great depths than at the surface; it is even possible, owing to the great compressibility of air, that it may contain more. As the increase in the density of the water at the depths at which we dredged was scarcely perceptible, we found no inconvenience at all from the pressure, except in one particular. The strong tarred hemp rope which we used belonged to the upper world, and, like all such terrestrial fabrics, it contained a large quantity of air. Down in the depths every particle of the air was squeezed out, and the fibres of the hemp and the tar were crushed together, so that the rope looked and cut almost like a stick of liquorice. I fear the rope became rather brittle, for it snapped once or twice without apparent cause, and we lost our dredges. This may turn out to be a serious difficulty in the way of dredging in much greater depths.

TEMPERATURE.

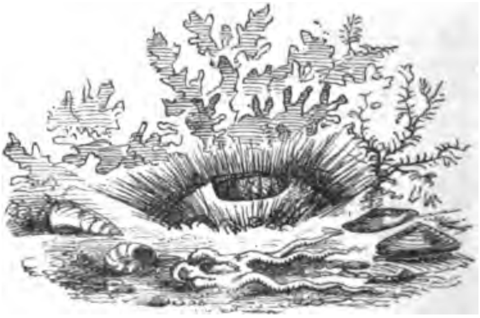
There has been up to the present time a strange misconception as to the temperature of the ocean—a misconception all the more singular as it is a point easy of approximate determination, and to which a good deal of attention has been directed. In all the leading text books on physical geography we have the reiterated statement that at a certain depth the ocean has a uniform temperature of 39° F.; that the ocean is, therefore, divided into three regions, bounded by the two Isotherms of 39° F.; that north and south of these lines the mean temperature of the surface is lower than that of the depths, while in the zone between them it is higher. Had the sea been fresh, it would have been perfectly intelligible that the water beyond the influence of currents and of direct solar heat, should have maintained the temperature of its point of greatest density; but it has long been well known, from the experiments of M. Depretz and others, that sea water contracts steadily down to its freezing point, which is about 28° F. when agitated, and as low as 25° F. when perfectly still.

Though I had often wondered what could be the cause, I believed in this permanent temperature of the sea thoroughly; and even suggested the particular course for our cruise, because it nearly coincided with the Isotherm of 40° F., expecting that we should be able within a few hundred feet of the surface, to eliminate the question of heat entirely from our calculations. To our very great surprise, the thermometers, two of which were sent down on the lead-line the day after we left Stornoway, to a depth of 500 fathoms, registered a minimum temperature of 49°, ten degrees *above* the "permanent point." We were at first inclined to mistrust the observation; but we took the same temperature at nearly the same spot on our return, when we were quite prepared to recognize it as the almost constant temperature of the warm, or Gulf Stream area of the region. Some days later, on leaving Thorshaven, and proceeding south-eastwards, we sounded, and took temperatures with three registering thermometers, in 510 fathoms, in lat. 60° 45′ N. and long. 4° 19′ W.; when the three thermometers, which were within about 2° of one another, gave a mean result of 32.2°; almost exactly the freezing point of fresh water, and more than 7° *below* the "permanent point." Many subsequent observations enabled us to determine that a cold area, where the thermometer ranged about 32° F., at a depth of from 4 to 500 fathoms, extended between lat. 60° and 61° N., and long. 4° 30′ and 7° 30′ W.; and that an area stretched north-westward, westward, and south-westward of this cold area; in which the thermometer, to the depth of 650 fathoms, was very permanent at 47·5° to 49° F. This is an unexpected result; but it is undoubtedly in the main correct. The soundings were made with the greatest care and with the best instruments, and several thermometers by different makers were employed on every occasion, every precaution being taken to avoid error.

Since the Gulf Stream, to which we attribute the warmth of the warm area, appears to affect the temperature of the sea to the very bottom, it is easy enough to conceive that the temperature may be permanent over a considerable region at 49°; but it is not so evident why the temperature of the cold area should remain permanently two or three degrees above the freezing point of salt water. It is possible that the freezing point may be the actual limit, and that the Sixes thermometers, which have large bulbs, register a degree or two too high, under the enormous pressure of 100 atmospheres. If this be the case, the condition of things must be very peculiar. Minute spicules of light fresh ice must be continually forming, and rushing upwards to be melted in the first shell of water whose temperature is above the freezing point. The animal inhabitants must live in perpetual winter—a winter not more severe, however, than that which is bravely borne by the myriads of limacinas and clios which sport in every crack in the ice fields of the Arctic sea.

NUTRITION.

The question of the mode of nutrition and life of animals at these great depths is a very singular one. The practical distinction between plants and animals is, that plants prepare the food of animals by decomposing certain inorganic substances which animals cannot use as food, and recombining their elements into organic compounds upon which animals can feed. This process is, however, constantly effected under the influence of light. There is little or no light in the depths, and naturally there are no plants: but the bottom of the sea is a mass of animal life. On what do these animals feed? The answer seems to be sufficiently simple: nearly all the animals—practically *all* the animals, for the small number of higher forms feed upon these—belong to one sub-kingdom, the Protozoa, whose distinctive character is that they have no special organs of nutrition, but that they absorb nourishment through the whole surface of their jelly-like bodies. Most of these animals secrete exquisitely-formed skeletons, sometimes of lime, sometimes of silica. There is no doubt that they extract both of these substances from the sea water, although silica often exists there in quantity so small as to elude detection by chemical tests. All sea water contains a certain quantity of organic matter in solution. Its sources are obvious. All rivers contain a large quantity: every shore is surrounded by a fringe which averages about a mile in width of olive and red sea-weeds: in the middle of the Atlantic there is a marine meadow, the Sargasso Sea, extending over three millions of square miles: the sea is full of animals which are constantly dying and decaying; and the water of the Gulf Stream, especially, courses round coasts where the supply of organic matter is enormous. It is, therefore, quite intelligible that a world of animals should live in these dark abysses, but it is a necessary condition that they should chiefly belong to a class capable of being supported by absorption through the surface, of matter in solution; developing but little heat; and incurring a very small amount of waste by any manifestation of vital activity. According to this view, it seems highly probable that at all periods of the earth's history, some form of the Protozoa, rhizopods, sponges, or both, predominated greatly over all other forms of animal life in the depths of the warmer regions of the sea; whether spreading, compact, and reef-like, as the Laurentian and Palæozoic eozoon; or in the form of myriads of separate organisms, as the globigerinæ and ventriculites of the chalk. The rhizopods, like the corals of a shallower zone, form huge accumulations of carbonate of lime, and it is probably to their agency that we must refer most of those great bands of limestone which have resisted time and change, and which come in here and there with their rich imbedded lettering, to mark, like milestones, the progress of the passing ages.



XXXI.—*On the Law of Symmetry as exemplified in Animal Forms.* By Alexander Macalister, M. D., Professor of Anatomy applied to the Fine Arts, Royal Dublin Society, being the substance of a Lecture delivered on the 24th of April, 1869.

When we stand on the slope of some Alpine height, and look across the low-lying valley, surveying mountain after mountain as they rise in wild and giant splendour, with their snow-clad summits reaching the clouds, the massive crags and overhanging cliffs above, the sombre pines moored in the rifted rocks below, the whole panorama of highland scenery fills our mind with emotion, and we exclaim, as we feast our eyes on the prospect, Beautiful! And turning from the view as we rest under the shade of some lofty rock, we pluck a slender fern-frond from its shady recess and examine its graceful form, its delicately-cut leaflets, and the same word often rises to our lips, and we characterize it as "Beautiful." But these two sensations, though expressed by the one word, are in reality diverse in their nature. The first feeling is properly one of awe, a sense of sublimity arising from our appreciation of the immensity of the objects surveyed, and of our own utter insignificance and powerlessness as contrasted with the stupendous forces whose agencies are visible on all sides, arising likewise from the association of these mighty agencies themselves with the material traces of their operations, as shown by the tendency to clothe them with supernatural attributes, seen in the manner in which the ancient mythologies peopled the wood, mountain, and lake with tutelary deities. The latter sensation is one of beauty, properly so called, which is as distinct from the former as are the feelings with which we listen to the rolling peals of thunder on the one hand, and to the sweet tones of the lute touched deftly by the skill of a master on the other.

Now in analyzing the latter sensation, or that of beauty, we are conscious that a certain fitness of primary and secondary qualities in any object leads us to view it with feelings of approbation, whether these qualities be of colour, taste, form, smell, or sound, and we find much difficulty in determining the cause of the approbation. Selecting beauty of form out of this group, we find an *à priori* difficulty in assigning a cause to this approbation, for in truth every group of objects has its own beauty.

The true nature of our idea of beauty in form has long been a favourite theme of metaphysical discussion and speculation. "The greatest men," says Le Chambre, a quaint French writer, in his book on 'The Character of the Passions,' "who have felt its effects have been ignorant of its cause; and we may say that it has made them lose their reason, both when they have been touched with the charms of it, and when they have attempted to say anything about that very charm which they felt."

How one group of particles gives to us a pleasing sensation when we view it, and another, mayhap of the same composition and quality, gives to us a feeling of loathing or dislike, it is certainly hard, at first sight, to understand; but it seems clear that the complex idea which we call beauty is one which springs from some impression in our own mind correlative with the physical qualities in the object of admiration—

> "Mind, mind alone,
> The living fountain in itself contains
> Of Beauteous and Sublime; here hand-in-hand
> Sit paramount the Graces; here enthroned
> Celestial Venus, with divinest airs,
> Invites the soul to never-fading joys."*

If this be admitted, that our appreciation of beauty is mental, it becomes our next stage in the inquiry whether objects have absolutely a power of producing this emotion in a reasonable mind, or whether our appreciation of beauty may depend upon external contingent circumstances associated with the object of regard. Is our emotion flexible or fixed? will that object, to which to-day we affix the idea beautiful, become ever to our appreciation, though absolutely unchanged in itself, undeserving of the title? Here we must carefully distinguish the spurious from the true idea, and we will find that we often profess to admire, for fashion's sake, things which, deprived of the gloss of fashionable usage and of the laudation of Parisian milliners, we would ridicule and stigmatize as hideous. In one of his lectures, Sir Joshua Reynolds remarks: "If an European, when he has cut off his beard, and put false hair on his head, or bound up his natural hair into regular hard knots, as unlike nature as he can possibly make it, and after having rendered them immovable by the help of the fat of hogs, has covered the whole with flour, laid on by a machine, with the utmost regularity; if, when thus attired, he issues forth and meets a Cherokee Indian who has bestowed as much time at his toilet, and laid on, with equal care and attention, his yellow and red ochre, as he judges most becoming, whoever of the two despises the other for his attention to the fashion of his country, whichever feels first provoked to laugh, is the barbarian."

Now, if this transitory admiration for fashion's sake be real; if we regard these matters of padding and distortion as true beauties, of course it must follow that beauty is a variable quantity, and has no fixed basis in nature. But beauty is not thus pliant in its character, but has its root in the nature of things, even as in chromatics, a harmony could never be obtained by a dress of orange, a shawl of yellow, and a bonnet of buff colour; and as in music the fourth and fifth of the ordinary scale could never produce a pleasing harmony, even on the uneducated ear, so we find the idea of beauty is in our mind connected with certain absolute qualities of material bodies.

---

* Akenside's "Pleasures of Imagination."

The last stage in this æsthetical inquiry is, what are the absolute qualities whose presence calls forth the answering response of admiration, that cause our minds to kneel naturally at the feet of beauty, and pay their tribute of spontaneous respect? Why do these masterpieces of Phidias and Praxiteles cause even the uneducated eye to pause with wonder at the mutilated limbs of their statues? To this point let us address ourselves for a few moments.

The celebrated classic architect Vitruvius remarked that symmetry results from proportion, and that proportion is the commensuration of the various constituent parts with the whole, in the existence of which symmetry is found to exist.

Now, in order that lines, surfaces, and solids, may be harmoniously related to the whole figure, of which they are constituents, they must accord to form a geometric figure, for in the construction of a geometrical figure alone is perfect harmony of parts to be found, and the harmonious proportions of these figures produce pleasing sensations in our minds when we view them, and these combine to form the complex idea which we call beauty.

This outline of a theory of beauty I consider to be more closely in accordance with the mental phenomena connected with its appreciation than any other, although it is objected to by Burke in his celebrated essay "On the Sublime and Beautiful." This author says that proportion is not essential as a constituent of beauty, but that it relates to convenience only, and should be regarded as a creature of the understanding, not as a primary cause acting on the senses and on the imagination.

That geometrical laws mould the elements of the mineral kingdom is well known to all. The mineral, properly so called, is crystalline, that is, has a definite shape bounded by angles, planes, and edges, combining to make a geometrical solid. Now, it has been asked, is this mathematical precision of moulding confined to inorganic forms alone, or do the beings making up the two organized kingdoms of nature participate in subjection to geometric law? To this question I think we may give an affirmative answer, and in the first part of our discourse to-day I intend endeavouring to illustrate this, in what I trust may prove a satisfactory manner.

The geometry of the crystal is essentially one of rectilinear forms—the simpler department of this branch of mathematics. The organic world is of a higher degree of complexity in structure, and its geometry is that of curved lines and curved surfaces—vastly more difficult than the former in its relations.

I do not claim any originality for the general principle to which I desire to direct your attention; for it is, at least, as old as Plato, who referred to the triangle all forms of the four elements—earth, air, fire, and water, and who associated the idea of beauty with the various modifications of triangle, pyramid, and cube—forms all reducible to the triangle. Nor was the mystical Platonic school the only one in which beauty was associated with geometric ratios; for Pamphilus, the distinguished master of Apelles, who flourished about 400 B. C., believed that no one could succeed in art—that is, in the correct delineation of human and animal forms—without a knowledge of arithmetic and geometry; and he resolved that to his school, as to the academic grove of Plato, the motto *Οὐδεις ἄγεωμετρητος εἰσειτω* should apply. Parrhasias, another eminent artist, is described by Quintilian as having accelerated the progress of art by being thoroughly conversant with the art of geometric proportion.

We know, likewise, that, in their palmy days, the Greek sculptors far excelled all their rivals; and an old writer, Christopher Leblon, informs us that Pythagoras brought to Greece, about five hundred years before our Lord, the key to harmonious proportions in form, colour, and music, and this unwritten science was treasured up by his followers with jealous care, and finally died out with them and their descendants; and it is due to the application of these principles that, in the eloquent words of the great sculptor, Flaxman, "the lines of Grecian compositions enchant the beholder by the harmony and proportion of their geometric outlines."

In later times, some few geometers, and still fewer naturalists, have, in a desultory manner, done some little to elucidate this most interesting and complex subject, and one of the most earnest and devoted of these investigators was one whose name I cannot mention without reverence—our beloved and revered father in anatomy, John Goodsir, of Edinburgh.

I have not as yet proposed for your acceptance any definition of the word symmetry, as I have used it in the title of this Lecture. By symmetry I mean that geometric regularity and correspondence of outline and structure which obtains between opposite and serial portions of the framework of individual animals, and the method which I intend to pursue in our present brief survey of symmetry is to direct your attention, firstly, to the geometrical forms discernible in animal structures; and secondly, to the subject of homologies—the relationship of the different parts of one animal to the corresponding parts of another, and those of serial correspondences in one individual animal.

1st. I will submit a few observations, which have been made upon the mathematical forms in nature. "In the investigations of animal forms," says Goodsir, "anatomists have been too much in the habit of regarding these forms and outlines from other than geometric standpoints; and, possibly, this may be a reason for the want of accuracy and exactitude which too often characterizes anatomical description. Anatomy has been hitherto advanced by the study of the animal form, and of the exact harmony under which only the animal could exist. But there is another view which might be taken. Is it not possible, by ascertaining the accurate shape, the form and proportions between the parts, organs, and whole body of the animal, to advance the study geometrically? Suppose the anatomist gave the exact curvature of the surface, the volume and proportions which different parts of the organs might bear, what their formal geometry might be might become matters of calculation. We might become certain, from that geometrical construction, as to the probable forms of other parts."* Anatomists have adopted mathematical principles in some few fields of research within the last few years; and, as one of the most striking illustrations of this, I may mention the calculations of the actions and forces of muscles, as deduced from their weights and cross-section, which have been made by Professor Haughton.

Whether there be such a thing as an ultimate structure in animal tissues, to which all others are reducible, is a matter which we cannot authoritatively decide in the present state of our knowledge; but of all the simple forms with which we are acquainted, the nucleated cell appears to be one of the most definite. For the benefit of my unprofessional auditors, I may explain that a cell, in biological language, is a particle of matter enclosed in a coating or wall, containing a spot called a nucleus, and capable, by splitting, of multiplying to an indefinite extent. Of such cells are many animal tissues made up, and the phenomena of their growth are among the most important in nature. Now, the typical shape of the cell, when influenced by pressure or other modifying agency, is spherical, cylindrical, or spheroidal; and from this form it departs when it is rendered the subject of pressure. Thus, in the choroid coat of the human eye the cells are, in outline, almost perfect hexagons—the form which a single layer of rather flattened cells would assume under pressure. The cells of plants, from pressure on all sides, very often assume the form of pentagonal dodecahedra.

Another of the essential and possibly primitive forms of animal tissue is the thread or fibre, an attenuated cylinder, which, according to Haller, holds the same place in Physiology that the line does in Geometry.

Now, in the science of mineralogy, we are all familiar with the fact that in any crystal, no matter how large soever it may be, all its particles are likewise crystalline. Conversely, in the animal kingdom, these particles before mentioned, of geometric regularity of outline, build up bodies, which, in their typical forms, still come under the dominion of mathematical law. The forms of symmetry among animals are referrible to the line, the circle, sphere, spiral, and plane.

I will only at present draw your attention to the spiral as illustrated in nature.

I will take it for granted, that you are all sufficiently well acquainted with geometrical forms to know what a spiral is. The plane spiral is produced by the rotation of a point around an imaginary axis, with a gradually elongating distance or radius vector, and a solid spiral, as that of one of these shells is produced by the revolution of the perimeter of a geometrical figure around a central axis. Geometricians are acquainted with a large number of such curves, of which the most important are the Archimedean, the spiral of Pappus, logarithmic, parabolic, trochoid, &c, some of which we will find exemplified in nature. The simple spiral of Archimedes is that whose formation I have described above, and it is one of the forms of this oft-recurring geometrical figure which is most frequent in its occurrence, and most simple in its relations. The largest number and most perfect specimens of spirals occur in the divisions of the animal kingdom called Mollusca and Foraminifera, and from these mainly will I take my illustrations.

---

* Goodsir's Anatomical Works, vol. ii., p. 269.

The spiral may vary by being single, as a right or left-handed curve, or in some cases, both co-existing, may intersect, forming a double spiral, or the axis may be a point, a line, or a disc. The remarkable rhizopodal fossil the Nummulite gives us in its shell a very perfect idea of the spiral of Archimedes. Each of these shells is made up of chambers freely communicating with each other. The animal which makes it up is, if we may judge analogically from its living relatives, a soft-bodied, gelatinous creature, composed of a granular soft structureless material, devoid of limbs, organs, mouth, or nervous system. We may contrast with its single spiral a double spiral, such as the living Orbitolite, or the fossil Receptaculites Neptuni, a gigantic Palæozoic Rhizopod, whose shells must have measured in some cases twelve inches across. These give us examples of perfect double intersecting spirals, which remind us of those magic lantern slides, commonly known as Chinese fireworks, or the engine turning on the back of a watch, right and left-handed spirals of Archimedes, starting from, and revolving at equal angles around a common axis. All discoidal spiral shells exhibit to us some variety of this curve; and they vary not only in their direction, in the proportionate degree of increase in the radius vector, and angle, but in the form of the generating figure. Now it was pointed out by the Rev. Canon Moseley, late of Cambridge, in a paper published in the "Philosophical Transactions" for 1838, that this generating figure in univalve molluscs, like the Whelk, Nerite, and Turbo, corresponded in shape to the operculum, and that the perimeter of this figure, while it underwent expansion and growth, yet always remained true to its specific geometrical forms. The shape of a shell of this kind would thus depend upon two conditions: 1st, the form of the generating figure, and secondly, its rate of increase in size, as determining the increase of the radius vector. In some of these shells, as *Conus vexillum*, *millepunctatus*, *literatus*, the producing figure is a more or less elongated rectangle; in *Turbo Lajonkairii*, it is almost a perfect circle; in many *Neritæ* a semicircle; in some Strombi, a triangle; but most commonly it is a complex curvilinear figure of double curvature.

Of all discoid shells, one of the most interesting, geometrically, is the pearly Nautilus (Nautilus Pompilius), and, perhaps as a consequence, it is one of the most beautiful objects in nature. If we make a vertical section through this shell we observe that it is of an exquisite spiral shape, generated by the rotation of a semi-ellipse around its minor axis, divided by septa into radiating chambers. If now we draw a straight line from the centre to the circumference of this section of a Nautilus shell, we observe that it cuts across three whorls of the spiral curve, and if we measure each of these whorls as their margins impinge on our right line, we will find that they all have a definite relation to each other in point of breadth; that each one is three times as wide as that which precedes it, as we pass from within outwards; it is thus a spiral whose coils expand in a certain uniform proportion, so that if we inscribe it within a circle, and divide its circumference into equal parts, the radii or lines drawn from the centre to the points separating the equal segments of the circumference will be cut by the spire in such a manner that the radii vectores of the different portions of the spiral will be continuous proportionals, the one to the other. The spiral is thus logarithmic, that is, one in which the tangent forms a constant angle with the radius vector; and when we draw lines from its pole to the periphery, inclined to one another at the same angle, they will intercept branches of the curve, which, however different in linear dimensions, will be geometrically similar to each other. I have placed in a tabular form the measurements of specimens of Nautilus and other univalves in the Museum, and I have placed beside them, in a tabular form, the terms of corresponding geometrical progressions.

TEREBRA SUBULATA.

Average width of whorls, . .	·641	·47	·432	·367	·32	·265	·23	·2	·175
Geomet. progression,	·57424	·49375	·43315	·37244	·32024	·27586	.23677	·20358	·175
Common ratio, =	·1·168								

TEREBRA CRENULATA.

Average width of whorls,	·6	·496	·38	·32	·25	·2
Geometrical progression,	·61047	·48838	·3906	·3125	.25	·2
Common ratio, =	·1·25					

TEREBRA DIMIDIATA.

Average width of whorls,	·88	·62	·52	·4	·31	·267	·2
Geometrical progression,	·8578	·67917	·53185	·41848	·32614	·2554	·2
Common ratio, =	1·277						

TEREBRA MACULATA.

Average width of whorl, . .	·9	·7	·52	·45	·37	·20	·23	·176	·15
Geomet. progression,	·88935	·71140	·56912	·45531	·36425	·29140	·23312	·1865	·15
Common ratio, =	·1·25								

NAUTILUS POMPILIUS.

Average width of whorl,	2·040	·680	·2265
Geometrical progression,	2·0385	.6795	.2265
Common ratio =	3.		

EUOMPHALUS PENTAGULATUS.

Average width of whorl,	·48	·25	·125
Geometrical progression,	·5	·25	·125
Common ratio, =	2·		

FUSUS ANTIQUUS.

Average width of whorl,	·84	·54	·348	·225	·15
Geometrical progression,	.799875	·53325	·3555	·237	·158
Common ratio, =	1·5				

FUSUS COLUS.

Average width of whorl,	·825	·54	·426	·35	·26	·2	·15
Geometrical progression,	·8366	·6281	·4722	·3544	·2661	·1998	·15
Common ratio, =	1·332						

FUSUS LONGISSIMUS.

Average width of whorl,	·81	·6	·44	·3	·25
Geometrical progression,	·8108	·6047	·4495	·3352	·25
Common ratio, =	1·341				

FUSUS COLOSSEUS.

Average width of whorl,	·76	·43	·268	·14	·085
Geometrical progression,	·78196	·4569	·267	·156	·1002
Common ratio, =	1·711				

SAME (VARIETY.)

Average width of whorl,	·675	·425	·25	·175
Geometrical progression,	·6402	·4154	·2696	·175
Common ratio, =	1·541			

MITRA EPISCOPALIS.

Average width of whorl,	·82	·575	·4	·245
Geometrical progression,	·825	·575	·4007	·2783
Common ratio, =	1·434			

DOLIUM ZONATUM.

Average width of whorl,	·525	·25	·125
Geometrical progression,	·515	·25	1·19
Common ratio, =	2·1		

TURBO DUPLICATUS.

Average width of whorl,	1·31	1·12	·94	·8	·67	·57	·48	·41
Geometrical progression,	1·31	1·109	·94	·79	·67	·57	·48	
Common ratio, =	1·1805							

This logarithmic spiral, which is exemplified in these shells, has other interesting relations worthy of notice. It was observed by Newton, in his "Principia," that if the force of attraction generally varied as the inverse cube instead of as the inverse square of the distance, the heavenly bodies would revolve, not in ellipses, but in logarithmic spirals, and thus rapidly would they diffuse themselves and rush into space. "It would be curious," says Goodsir, "if the law of the square should be the law of attraction, the law of the cube might therefore prove to be the law of production. Thus cellules may multiply from cellules on a rapidly increasing geometric ratio. Probably the logarithmic spiral may be the law at work in the increase of organic bodies."

It will be seen in the diagram that the radii vectores of these spirals are all in geometrical progression, and that the ratios of the diameters of the successively increasing whorls can be expressed numerically, except in case of manifest deformity. If these ratios be constant, it would certainly be a valuable assistance to systematic malacologists in the discrimination of allied species, although, reasoning from analogy, one would expect to find in their numbers an accurate mathematical measure of species-transmutation. Thus it will be seen that the very closely allied species *Terebra maculata* and *subulata* differ typically only by a difference of ratio amounting to ·087; *Terebra dimidiata* differs from *maculata* by ·027; and *T. crenulata* agrees in formula with its ally, *T. maculata.*

Similarly, the variation between *Fusus colus* and *longissimus* amounts to a difference in ratio of ·009. In some of the individuals measured, these variations were displayed in a striking and interesting manner. I have merely selected, as far as possible, typical specimens for measurement, and have avoided cumbering the statistical tables with an undue amount of figures, reserving these for a more systematic enumeration.

The Rev. Canon Moseley directs attention to the *operculum* in the process of growth, showing that in some forms it rotates on its own axis while being enlarged and advanced; the rotation being in a direction opposite to that in which it revolves around the central shell axis, and thus the enlargement of the *operculum* takes place, not by additions all round the margin, but at one place, and these periodic growth seasons leave marks on the surface, each growth period increasing the *operculum* in such a manner that one stage is to its size at another in the ratio of their respective radii vectores. In some few shells the *operculum* increases by regular circles, as in the beautiful *Delphinula laciniata* from Singapore; in others, by ellipses, and others more complex forms of curve. It will also be seen that discoid shells differ from turbinated in the nature of the axis; the latter sliding along a line, around which the generating figure revolves, the former retaining to the axis a constant relation of plane; hence the rate of this motion is another factor to be considered in determining the shape of the shell.

Thus far have we traced the symmetry of the spiral in organic forms, and their relation to mathematical law seems plain. The relationships of the other geometric forms, although not of equal simplicity, yet are equally demonstrable. But besides the mathematical unity which pervades all organic nature, there is a vital unity in the animal, a resemblance in structure, development, and nature between the parts of one animal and those of another, and a correspondence between the various component elements of the body in a certain order or series: to these correspondences we give the name of homologies, homology being that branch of anatomy which recognizes the correspondences and interprets the nature and affinities of organs.

Many years since, a dreaming German naturalist, while musing upon a deer's skull, found bleaching in the forest, was struck by the thought, this skull is made up of modified vertebræ, and this germ of Göthean philosophy has borne fruit in the science of Transcendental Anatomy, or homology, properly so called. Owen, Oken, Spix, Vicq D'Azyr, Carus, and a host of others too numerous to name, have all contributed to its progress by their labours, and this in spite of the scoffing of the *soi disant* practical school of comparative anatomists, including even the celebrated Cuvier. One of these objectors, in speaking of the science of homologies, says—"*Pour moi une machoire superieure est une machoire superieure, et un bras est un bras. Il ne faut pas chercher a faire sortir l'osteologie d'un systeme de metaphysique.*"

At the present day, however, all anatomists agree that homologies are among the most important studies in biological science.

Are all vertebrate animals constructed upon the same plan? is a question which will at once be answered in the affirmative by any thoughtful anatomist. Take these varying types of vertebrate life—man, monkey, cat, bird, reptile, fish—and see, in their variable forms, how the same parts are repeated: the upper limb may be a hand, a paw, a pillar of support, an organ of climbing, of tearing, a wing, a paddle, or a fin; but it is still an upper limb, with the same component elements—shouldergirdle, humerus, radius and ulna, carpus, metacarpus and phalanges. The vertebræ are of the same nature in all; and the skulls, with all their diversity, preserve such an unity, that the names of the bones which make up the complex fish skull will apply to those of the simpler mammalian cranium. It is needless further to delay upon this point; so we arrive at the conclusion that all vertebrate animals are built up on the same general plan.

The question next arises—What is the general plan upon which the vertebrate animal is built? And here the various biological schools join issue. The upholders of evolution, admitting the conclusion just arrived at, will say that the general plan is the structure of the being from which the ancestors of the variable vertebrate form have sprung, and that, in the course of time, varying habits and means of life, or, mayhap, intercurrent accidental conditions, have produced the divergences from the central form, which form, however, need not be equal in complexity or perfection to its varying modifications, for the causes inducing variety, if they act with sufficient force and continuity, are competent to induce the formation of new organs or new sets of organs; and these philosophers, including many of our most renowned names in science—pre-eminent among whom stands the most philosophic exponent of evolution, Mr. Herbert Spencer—point to the impracticability of absolutely formulating typical structures as one of the strongest arguments in favour of development.

A second school, while holding the doctrine that species are variable within wide limits, yet regard the doctrine of complete evolution from protogenic forms as not proven, and teach us that, although the plasticity of form in nature is sufficient, under the pressure of modifying forces such as those specified, to permit of the variation of existing germs to a very great extent; yet that the development of new organs by the action of necessity or of variation depending on the struggle for life, is doubtful, or probably impossible. Those who hold this theory consistently must believe all inferior vertebrate forms to be the consequences of degradation.

A third school of biologists, admitting the evolution hypothesis as that by which forms and organs were originated, believe that these forms, in course of their final modifications, unfold themselves from their simplest to their most complex state, after a definite ideal type—a type not to be found in actual tangible form—existing as a whole, but whose properties are, in some sense, the moulds by which the protogenic forms, plastic only in this one direction, are modelled. This hypothesis clears us of the difficulty urged by Herbert Spencer, that the theory of a fixed invariable archetype implies the absolute existence of such; and as this *archetypus* cannot be found in nature, we have no basis upon which to build the theory, as the individual modifications of special organs cannot, in many cases, be interpreted on the degradation hypothesis, the type on this hypothesis is the Creator's plan—and of course presupposes an intelligent, supreme Creative Power, but this is, in the minds of the great majority of thinking men, a strong *à priori* argument in its favour.

A fourth school of philosophers disregard altogether the natural deductions from morphology, and believe that every so-called specific form is a type for itself; so that subordination to general typical form has no connexion with relationship in development. So that, when in one animal an organ exists, reduced to a useless rudiment, as the ischiatic bones of cetaceans or the cæcal vermiform appendage, this school would interpret these as indices kindly given to zoologists by the Creator, in order to teach them the affinities of whales, &c.—a proceeding which would only be paralleled by a Grecian architect placing upon the roof of a gorgeous temple a small portion of thatch, in order to show to archæologists and students of art the connexions in nature between the sacred edifice and the hovel of a savage. Such a theory has a tendency to degrade our ideas of the All-Powerful and Ever-Present Ruler of the Universe; and it fails in the hands of its most able exponent, Hugh Miller, to satisfy us as to its applicability. If we can read the teachings of Nature aright—

> If they speak truth at all,
> These voices must be true
> That give to visible forms
> These laws their honour due,
> And tell of one that brought us hither,
> Who holds the keys of whence and whither.*

It will be seen, that while the upholders of the first theory must consistently regard the unity of arrangement in vertebrate forms as a result of the correspondences of secondary causes, the supporters of the second and third believe in the existence of a type either real or ideal, and we cannot do better, in conclusion, than see some of the theories of type that have been held.

Professor Owen reduces all forms of vertebrate animal structure to

---

* "Reign of Law," F. T. Palgrave, Macmillan's Magazine.

the typical vertebra—which is explained in almost every hand-book of comparative anatomy. Modern anatomists, in many points, however, do not adopt this vertebra as suggested, but introduce modifications in the number and arrangement of the processes. Most of the followers of these biological schools, however, fully believe in this central truth—that the typical vertebra, in reality or idea, embodies a perfect symmetry; a transverse line separates two similar symmetrical parts, neural and hæmal; a vertical line likewise cuts off two symmetrical lateral parts; thus the symmetry of the typical vertebræ is one of planes radiating from a linear axis. Of repetitions of this primary bone are the skeletons of vertebrate animals made up; and even the skull is a series of modified vertebræ, according to Geoffroy St. Hilaire, Goodsir, and Owen. Some morphologists, as Professor Huxley, object to this consideration; but the objection is one of interpretation, and depends on the degree of importance which we may assign to the primitive segmentation of the notochord, as indicating serial homology. Contrasting the cervical, the thoracic, and abdominal, it will be seen that the same symmetrical homologies are detectible, modified only by specialization. Nay, not only are the bones arranged in series, but the muscles of the trunk are grouped in a regular symmetrical manner; the nerves and vessels likewise coincide in arrangement. The limbs are related to the vertebral column, as appendages—related either to one vertebra (Owen) or many (Goodsir), and each vertebrate limb is constructed upon the one plan. The bones, as before alluded to, are in all built on the same type, and each joint is furnished in a typical limb with a regular series of muscles, which in plan are perfectly symmetrical and radiant. These wonderful correspondences cannot fail to strike us with admiration at the plan upon which all creatures are built, and the forces by which they have been modified.

Now, of course all the actions which these muscles preside over cannot be permissible in every animal, and then the muscles which should accomplish them, gradually atrophy, and "becoming fine by degrees and beautifully less," as capacity for action diminishes, gradually disappear altogether. Thus, if we take as illustrations the muscles that rotate the bones of the forearm upon each other: in many of the higher animals, as man, these are perfectly developed. In the dog, one set, the pronators, are well marked, while the supinators are not so well developed. In the pig and its allies these muscles are reduced to a rudiment, and in the horse they disappear altogether. And such is the life history of any group of organs which we may take the trouble to trace.

To recapitulate the conclusions to which we have come, all vertebrate animals are built upon one plan: that plan we call the type. In process of development many forms stop short of the type, by reason of the rendering permanent of embryonic conditions: those that exhibit to us the nearest approaches to type structure vary by the application of modifying causes—the will of the great First Cause, either directly or indirectly expressed—and the farther the departure from the type, the nearer the degree of ordinary symmetry.

XXXII.—*On Nebulæ*. By ROBERT STAWELL BALL, M. A., Professor of Applied Mathematics and Mechanism, Royal College of Science, being the substance of a Lecture delivered on the 17th of April, 1869.

NEBULÆ are celestial objects; nearly all of them are invisible to the naked eye. They are faint cloudy spots or stains of light on the black back-ground of the sky. They must be distinguished from clouds, in the ordinary meaning of the word. The latter exist in the atmosphere, while nebulæ are plunged in the depths of space. Clouds shine only by the light of the sun, which is reflected from them. Nebulæ shine with no borrowed light: they are self-luminous. Clouds change from hour to hour. Nebulæ change not from year to year. Clouds are far smaller than the earth. The smallest visible nebula is incomparably greater than the sun. Clouds are within a few miles of the earth. Nebulæ are not within many millions.

There are about four thousand nebulæ known; they are scattered over both hemispheres, and some are to be found in every constellation. They differ from one another as four thousand pebbles selected at random on a sea beach might differ, namely, in form, size, colour, and material; but yet have, like the pebbles, a certain generic resemblance.

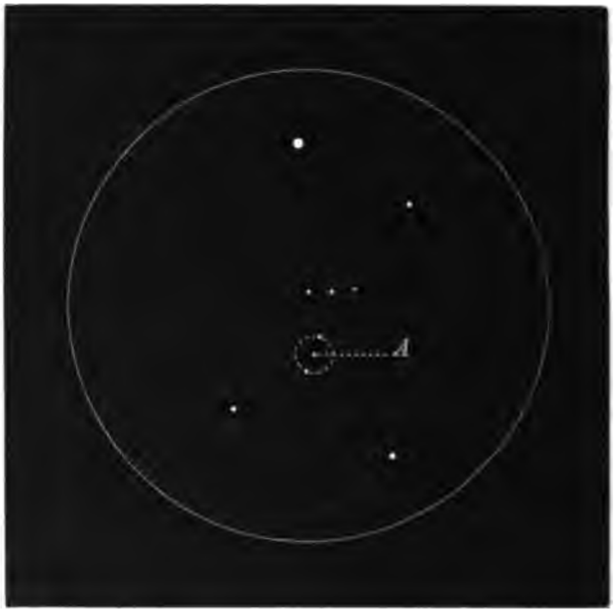
To describe this class of bodies, it is convenient to take one of them as a basis for the Lecture, to enter upon it minutely, and to illustrate it by occasional reference to other nebulæ. There is no difficulty in selecting a nebula for this purpose. That to be found in the constellation of Orion is the most suitable, by reason of its size, its brilliancy, the care with which it has been observed, and the success which has crowned the recent efforts to obtain some knowledge of its nature.

The constellation of Orion is well known. In the diagram (Fig. 1) a few of its principal stars are represented. A is the middle of the three stars which form the sword handle. Above the handle are the three stars which form the well-known belt. The star A presents no remarkable appearance to the naked eye. About two centuries ago, Huyghens first pointed a telescope at it, and saw around it a luminous haze. Ever since the time of Huyghens the object has been diligently observed. Probably for the last hundred years a night has not elapsed that this nebula has not been watched by some astronomer. Any ordinary telescope will show the object to some extent, but the more powerful the instrument, the more are the curious details revealed.

The star A, which appears single to the unaided eye, really consists of six stars, as in the diagram (Fig. 2); these are placed so close together that their commingled rays cannot be distinguished without a telescope. These stars are each of them suns, comparable, it may be, with our own in magnitude. Surrounding these stars, and extending out for a great distance into the neighbouring space, is the great nebula.

The small circle drawn around the star, marked A, Fig. 1., represents the extent of the nebula roughly, so far as to indicate about the amount of sky it occupies. The field of view in a large telescope will not indicate all this at once.

Fig. 1.



The nebula is of a faint bluish colour, impossible to represent by a drawing. The brightness of the neb is greater in some places than in others; it has no definite boundary, but with every increase in the power of the instrument new faint branches can be seen. There is an empty space immediately surrounding the multiple star, as if they had absorbed the adjacent nebula into their substance.

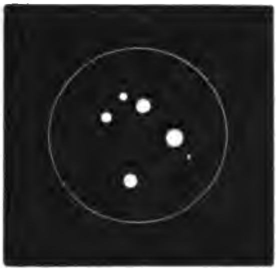
The engraving of the nebula in the plate represents in a reduced form the drawing* of the object which has been made by the Earl of Rosse, at Parsonstown. Scattered on the surface of it a number of minute stars will be observed. There are about two hundred of them; they are all invisible to the naked eye. It is not necessary to believe that they are in the substance of the nebula; they may be either in front of it or

---

* At the Lecture an enlarged copy of Lord Rosse's drawing was exhibited. The illustration of the nebula here presented is due to the kindness of Messrs. De La Rue and Co.

(less probably) behind it, and so projected upon the same part of the sky as the nebula. The relative positions of these stars were carefully measured, under the direction of Mr. Struve, the Astronomer Royal of Russia. A chart of these stars was constructed at Parsonstown, and on them, as a sort of skeleton, the details of the nebula were drawn. The execution of this drawing tasked the powers of the great telescope for a period of seven years; but then it must be remembered that it is only during a part of the year that the nebula is above the horizon after dark. Very fine nights are necessary for observing all these objects; there must be no mist or fog; the moon must be absent, for its bright light would quite extinguish the faint gleams of a nebula. The milky way should be seen clearly and vividly. In fact, taking the weather alone into consideration, there are only about one hundred hours in the whole year which are suited for the very best astronomical observation. When it is further remembered that the nebula in Orion will only be within reach of the great telescope for one hour, or rather less, each evening, that unless the sky be clear during this time, the whole night, for that particular object, is lost, it will be understood how long a time must be occupied in the completion of an elaborate drawing. There is also considerable difficulty in seeing the fainter portions of this nebula. The long projecting arms which appear so plain in the drawing can only be seen by the most careful scrutiny with a practised eye. A little will be seen one night. This will be verified on a subsequent evening, and the faint object will be traced a little further. But this faintness is only to be understood as applying to the outlying portions; the central part of the nebula is bright enough to be seen in any telescope, and in the great instrument presents a scene of surpassing glory.

Fig. 2.



The astronomical importance of this magnificent drawing is twofold. As a geographer would survey a new country for the sake of ascertaining the details of its mountains, its plains, and rivers, as he would sketch the most important features in the scenery, and fill his note books with descriptions and measurements, so does the astronomer consider a simple survey of the heavens as one of the numerous duties to be discharged by the members of his fraternity. The contents of the heavens are to be measured, described, and drawn; and the result ultimately to be aimed at is a complete and exhaustive delineation of the size, magnitude, position, and peculiar features of every star, nebula, and planet, which the utmost powers of our greatest instruments can disclose to us. Should this mighty task ever be completed, it would be, indeed, a noble monument of human industry and skill; and whatever we may think of the possibility of its final completion, there can be no doubt that important contributions to this grand end are published every year. We have extensive catalogues of stars, exquisitely delineated charts of special portions of the sky, drawings of craters in the moon, drawings of planets, measures of double stars, and drawings of nebulæ. These are the results of special surveys of different provinces in the vast kingdom. Among the contributions for this grand object, one of the most prominent places must be assigned to the great drawing of the nebula in Orion, executed by the Earl of Rosse. In this general work of surveying, an accurate delineation of the most marvellous of the nebulæ is surely an important item; it represents the most curious object in the heavens, as seen by the most powerful telescope on the earth.

The laborious work of surveying is the first and simplest duty of the astronomer, for more difficult, and perhaps more interesting problems lie behind. One of these is to determine the movements of the heavenly bodies; another, and this is the most obscure of all, to determine their nature. The drawing of Orion is designed to throw light upon the movements of the nebula, if any, and upon its actual structure and condition. It is a most interesting question to decide whether this great nebula changes: looked at from night to night it alters not; and from year to year it appears the same; the arms, the brightness of the different parts do not wax or wane, become absorbed, extended, dissipated, or dispersed, like the clouds on a summer sky, which they so much resemble. But how are we to decide the question as to whether it changes at all? The life of an astronomer is not long enough, even if his memory were good enough, to pronounce finally upon this question; but by making an elaborate drawing with the utmost care and precision, by measuring the positions of the stars with the last degree of exactness, and by careful comparison, ascertaining that each minute portion of the drawing represents the corresponding part of the nebula as closely as it is possible for art to represent nature, the steel plate on which that drawing has been engraved may be handed down to posterity, with the inscription—"This represents the great nebula in Orion, as seen between the years 1860 and 1866." It may be after the lapse of a hundred years that this object will be drawn by some other astronomer, who will undoubtedly compare his drawing with that borne on the indelible steel, and then it will be seen whether or not changes have taken place—changes which may reveal to us more of the nature of this wonderful object, and of the laws which govern it, than we could have hoped to have acquired without such a means of comparison. Great, then, as are the thanks due and cheerfully rendered by contemporary astronomers to the Earl of Rosse for his noble contribution to their science, it is, perhaps, by a future generation that to his name will be awarded a share in discoveries which only his labours have rendered possible.

The magnitude of this vast nebula can, perhaps, never become known to us. In fact, the light of it fades away so gradually, that we can assign no definite boundary to some portions of it; we cannot tell how large a portion of the sky it really occupies. What can be seen of it certainly covers a space about two or three times the apparent space that the moon occupies. But what shall we say of the real magnitude of the object? As we do not know its distance, we cannot, of course, state, with any accuracy, its real bulk; but an idea can be given of a minor limit to its dimensions. The magnitude of our Earth, vast as it is, will not serve as a means of comparison; we must seek some far larger unit for our measurement. The Earth describes around the sun a mighty path every year; it is nearly a circle, and the diameter of that grand circle is about two hundred millions of miles. Let us imagine a vast sphere, formed so large that it will just pass through this mighty circle, and let this stupendous globe serve as a measure whereby we can estimate the bulk of the great nebula in Orion. We shall find that a million of these globes rolled into one would not exceed the great nebula in magnitude. We know for certain that the nebula must be as large as this, but how much larger it is impossible to say.

The actual nature of this body is a problem of the highest interest; and it will be necessary to go into some detail to explain what astronomers know on the subject. For a long time a controversy reigned with reference to the composition of nebulæ, and. it is only by the light of some recent discoveries that the question has been finally set at rest. This subject will perhaps be best understood by the help of the accompanying illustration. There is in the constellation Hercules a dull, luminous spot, just visible to the naked eye on a dark night; viewed through a telescope of moderate dimensions, it presents a dim, misty appearance, such as that which is now represented on the screen; but the scene is very much changed when a great telescope is directed to this object: the mistiness and cloudiness vanish, and instead of it a magnificent cluster of distinct but minute stars astonish the beholder. By a simple optical arrangement we can produce this change on the dull spot which is on the screen. This being done, you see a number of minute stars; the rays from each individual star were before merged into a gleam which united them, but now they shine out single, distinct, and clear. That cluster is one of the most gorgeous objects in the heavens. It is believed that the number of stars composing it does not number less than 2000. It must be remembered that each of these stars is a sun, and we can picture to ourselves how splendid must be the heavens presented to an inhabitant of this system. Night must be there unknown, for when a thousand suns have set, another thousand suns have risen. This cluster in Hercules then appears, in a small telescope, like a nebula, but in a large one it is seen to be a cluster. Following up this idea, it was urged with much plausibility that all what are called nebulæ in the heavens are in reality clusters, only that some are so distant, or the stars composing them are so small, that our telescopes have not been able to resolve them, as it is called.

Now, how far is this applicable to the great nebula in Orion? There have fortunately been one or two most interesting observations made on this point. On a particularly fine night, when the speculum of the telescope was in its finest order, the skilled eye of the Earl of Rosse and of his then assistant, Mr. Stoney, detected in the densest part of the nebula myriads of minute stars, which had never before been recognized by human eye. Unquestionably their commingled rays contributed not a little to the brilliancy of this portion. But there yet remains the further investigation as to whether the whole of the nebula is composed of stars, or whether the light from it may not partly arise from some other source. This question could not but force itself on the attention of one who has ever looked at the object. It is impossible to believe that the faint blue light is produced by solid hot masses; the object is so misty—I had almost said so ghostlike—that we expect to find it of some gaseous matter. But here a difficulty arises: the nebula is luminous, but ordinary gas is not. This room is full of a mixture of two gases, yet we see it not. How, then, if the nebula consisted of gas, would we see it shining on the far-distant heavens? Here we have recourse to experiment, which will get over this difficulty for us. This is a tube containing a small quantity of hydrogen gas. This gas is invisible: no one could tell, by looking at the tube, whether it contained gas or not. But I have here an electric battery, by means of which I pour a stream of electricity through the tube. Now you see it glowing with a violet light, visible to all the room. Now, what has the electricity done for us here? Its sole effect has been to heat the gas; it is merely a convenient means of heating the gas and making it glow. It is not the electricity itself which we see, it is only the gas, heated by the electricity. We infer, then, that if gas be sufficiently heated, it becomes luminous. The gas does not burn. This tube contains exactly the same amount of hydrogen after the experiment as it did before: just as red hot iron glows from the heat it contains, so does the gas. If, then, we could believe that in the great nebula in Orion there were vast quantities of gas raised to as high a temperature as the electricity raised the hydrogen in the tube, we would expect to find this gas is self-luminous; and that such a high temperature should exist in the nebula is easy to believe, knowing, as we do, how hot the sun and other heavenly bodies undoubtedly are.

We have reached now to this point in our examination of the nebula in Orion; we have shown that it is unquestionably true that myriads of stars are to be found in the nebula, and we have seen good reason to believe it possible that these stars may be associated with glowing gas; but how are we to decide emphatically on the point as to whether this gas does really exist? To settle this point, it will be necessary to proceed by a totally different method of inquiry, the nature of which will require some explanation.

The colour of a light will often give us information as to the source from whence the light has been derived. By the help of a platinum wire I put a few crystals into this Bunsen flame; instantly you all see the greenish hue with which the flame is tinged. There are many present who, from the colour of the flame alone, could easily recognize that the crystals contained the substance called baryta—that green flame is a test of baryta. So when I put another salt into the flame the crimson colour is at once recognized of lithia, and though the atom of salt I have used is so small as not to be visible beyond a very short distance, yet the particular hue of the flame proclaims distinctly the fact that lithia has been used. Here is still one more example. In this great blaze is a peculiar and rather ghastly yellow light, which is at once recognized to belong to the element soda. Here, then, are three cases in which the colour of the flame has fully declared the presence of a certain body. Now, there are not quite seventy different bodies or elements, as they are called, and all of these can, by suitable arrangements, not necessary to mention, be burned, or at all events made to yield their peculiar light. Hence, if we knew accurately the precise hue which each body produced, we should, whenever we saw the peculiar light of any one, be able to tell the element which produced it. But, supposing two or more of these elements were mingled together, and that the light was thus produced from a combination, how are we to proceed? A skilful musician can, it is said, when listening to a band of music, isolate his attention on the sounds produced by one particular instrument. But I do not think the most accomplished artist, however skilled he might be in his knowledge of colour, could unravel all the different hues that would be blended in a mixture of different-coloured lights. We must adopt a different method. Supposing that some source of light is examined through a prism, all the different colours which may be contained in it are revealed in a wonderful manner. If there be red, it is seen in one place; if blue, in another; if yellow, in another. So that, by examination with a prism we find it possible to decipher completely the nature of the source of light which we are looking at. On the screen you now see represented drawings of the appearances presented through the prism by the different substances, when burning or sufficiently heated. Here you see a bright yellow line—this is soda; here a red one—this is lithia; while that group of green ones is produced by baryta. Supposing, then, we construct a table for all the different bodies in nature; and supposing that in this table is represented the appearance which the corresponding body has when viewed through the prism, we shall be able to analyze any light that we require. The process of doing so is as follows:—We pass the light through a prism, and we then compare what we see with the table. It will be found that some of the bands of light can be identified with bands in our table of comparison, and we instantly infer that the corresponding bodies are present in the source of light which we are examining.

Supposing that we proceed to apply this method to determine, if we can, the materials out of which the nebulæ are composed, we attach to our telescope an instrument of which you see a representation on the screen; it is simply a means of conveniently passing the light through the prisms, and of observing the result. Now these observations are attended with very great practical difficulties; and it is only within the last few years that they have been overcome by the skill of Mr. Huggins. Other observers, following in his wake, have likewise been successful.

Let us first look at some of the objects to which this beautiful method has been applied. You see on the screen now an enlarged photograph of the nebula, which is known as the "dumb bell." It does not much resemble a dumb bell in this drawing. The fancied resemblance is only to be seen in a small instrument. When great power is applied, then a multitude of minor details are revealed that completely destroy the resemblance. Hence, as this has been copied from Lord Rosse's sketch, which was made with the great instrument, the name which has been applied to it seems hardly just.

The next of the nebulæ which we shall mention is that which is called Saturn nebula. It is so called from the fact that it seems to mimic, in the celestial spaces, the Saturn of our own system. It is what is called a planetary nebula—a round, sharp, clear object, with two projecting wings, which somewhat resemble the appearance that Saturn presents. We now know that this nebula is a vast globe of glowing gas.

Another very curious object to which the same method of investigation has been successfully applied is the annular nebula of Lyra; it is a perfect ring of bright glowing material.

The great nebula in Orion has likewise been examined, and the result which has been obtained is represented on the screen. It consists of three bright lines of light. I have had the opportunity of seeing these lines with the help of the great telescope at Parsonstown, and they look like bright and beautiful silver threads stretched across the dark field. These three lines we are now to compare with the table, and see if we can recognize in them any of the bodies which are found on the earth. On the screen are represented the three lines found in the nebula, and two of the lines of other elements, with which they have been compared. It is seen that one of these lines is identical with a line produced by hydrogen; that one is identical with a line produced by nitrogen; while the third line probably represents nothing which we know on earth.

We have then now solved the great problem as to the constitution of the nebula in Orion; we see that it consists in part of stars, making up in number for what they want in size, and bathed in and surrounded by a huge mass of heated and glowing gas, partly consisting of that gas which enters so largely into the composition of our ocean, namely, hydrogen; partly of that which is so great an ingredient in our atmosphere—nitrogen; further, that these are mingled with some other gas, of whose nature we are completely ignorant.

Here, at last, we have reached the confines of the unknown. It is wonderful to think that we have been able to make out anything with reference to these distant objects; but we have traversed the road as far as it has yet been opened, and can go no further. Science is making rapid strides; every few months latterly has witnessed some engrossing discovery; and I think it very possible that, had it fallen to my lot to lecture in 1870, instead of 1869, it would have been my privilege to have communicated to you some other facts about the nebulæ. But we must not be too sanguine. There is one problem of the deepest interest which all astronomers often turn over in their thoughts, and which they as often despair of seeing satisfactorily settled. That problem is this—how to find the distance of a nebula. The difficulties of finding the distance of a star are so great, that it is only by the most lavish expenditure of skill and patience that it can be accomplished; but the difficulties are infinitely greater and apparently insurmountable for the nebulæ, and no method has yet been devised which will enable us to resolve this mighty problem. But we are not altogether without light. We cannot tell how great this distance may be; but we can, with great probability, if not certainty, assign a minor limit to this distance.

Let me endeavour to illustrate this to you. Our ordinary measures of miles are of no avail for such magnitudes as we shall have to encounter; we must call in a far longer measuring-tape, and fortunately we have one well suited to the purpose. Supposing that far away in the heavens a new sun were to be summoned into existence, would we see it the very instant it was created? We would not. From its brilliant surface light would be poured out in all directions; that light would dash through space with terrific velocity; but until it reached our earth and entered our eyes we would not realize the fact that a new body had been added to the universe; and awful is the rate at which light travels—it would dash seven times round the earth in one second.

Now, you will understand all we know about the distance of a nebula; the light produced by it rushes to us with this terrific speed of 185,000 miles per second. But how long does it take for its journey? Moving at this rate, we should think the journey would be a short one, but it is not. It is believed most firmly by those most competent to judge that the nebulæ are plunged in the profundity of space to such an appalling distance, that the light from some of them takes centuries to reach the earth. Their distance may be much greater, but it cannot be less than this. We see these nebulæ, not as they are now, but as they were hundreds of years ago; and were one of these bodies to be struck from existence by the fiat of Omnipotence, posterity for many generations might still observe, measure, and draw the object long after it had ceased to exist.

At this climax I bid farewell to our subject. We have reached a point where man's intellect begins to fail to yield him any more light, and where his imagination has already succumbed in the endeavour to realize what he has gained.

XXXIII.—*The Beet-Root Sugar Manufacture in Ireland.* By ARNOLD BARUCHSON, ESQ.

[Read Dec. 21st, 1868.]

THAT sugar has become a necessary of life in these kingdoms to a greater extent than in any other country; that its production is a source of great profit to foreigners; and that were we able to produce it without recourse to them, our national wealth would increase to a most gratifying and desirable extent, are truths universally admitted. But, that within a few years hence all the sugar used in these countries will possibly, and even probably, be grown by ourselves, and manufactured within our own coasts; that we shall produce as much or even more for export; that the great profits and social advantages resulting will be an important addition to our resources; and that in Ireland, whose industry and natural advantages most need development, the great enterprise of effecting this will be successfully accomplished—these are propositions which a short time will suffice to establish, and the importance of which renders no apology necessary by their advocate. That advocate now stands before you. He asks this representative assembly of Irishmen to vouchsafe a thoughtful hearing while he states convictions arising from a lengthened and intimate acquaintance with *Beet-root and its various products.* He is confident that the gentlemen whom he is addressing will freely admit the importance of the subject, calmly weigh the suggestions about to be made, and then (if such a course appears to be desirable) promptly and vigorously give practical effect to their approval.

I am here, then, to urge the possibility of extensively cultivating Beet-root in this island, with a view to supplying Great Britain and other countries with the sugar and other valuable products thereof. But I cannot arrogate to myself the merit of having first perceived this possibility, or of being now alone in urging the enterprise. I am but a unit in the crowd of foreigners and Irishmen who, having carefully examined the facts, have afterwards urged that the enterprise be commenced. In this city—in this room—are gentlemen who long before I had drawn attention to it, told their countrymen that by cultivating Beet whole counties of Ireland might be made to rival the similar districts in France and Germany, which have so amazingly improved during the last thirty years. Yet I fear that Irishmen generally are not aware how rapid, steady, and undeniable this improvement has been. Previous to 1830, the northern and adjacent departments of France were almost devoid of manufacturing industry. They now contain between 400 and 500 Beet-root Sugar manufactories, producing annually 220,000 tons of sugar. The production, which in 1840 was but 22,000 tons, rose in 1845 to 37,000 tons; in 1850, to 64,000 tons; in 1855, to 77,000 tons; in 1860, to 120,000 tons; and in 1865, reached the enormous quantity of 274,000 tons. The effects of this on the national resources have been considerable. Dureau, writing in 1860, summed them up thus:—

	Francs.
Paid for Agricultural Products	45,000,000
Pulp, &c., returned to the soil	4,000,000
Sugar and Molasses manufactured	90,000,000
Wages and Salaries	46,000,000
Duty paid to Government	50,000,000
	235,000,000
Or sterling,	£9,400,000

But these large sums by no means represent the *present* state of affairs; for since the year 1860 France has about doubled her production of Beet-root, and therefore the total annual payments *now* arising from it may be set down at Eighteen Millions sterling!

Concurrently with, and in consequence of this, the northern Departments have entirely changed their industrial aspect. Distilleries, chemical works, iron and copper-smith works, have sprung up. Flax and cotton manufactures have multiplied ten-fold. The collieries in the Department du Nord have been developed. Railroads now traverse the country in all directions. Agriculture has become scientific and unprecedentedly lucrative. Land has greatly risen in value. The Beet-root districts are now the pride of the French nation, and amongst the most wealthy of the empire.

In the Zollverein, where the success achieved in France has excited vigorous emulation, changes not less gratifying have been the result. In 1840, 14,000 tons only were manufactured; but in 1850 the produce was 54,000 tons; in 1855, 87,000 tons; in 1860, 126,000 tons; in 1865, about 190,000 tons; and in this season probably 210,000 tons; whilst the impetus given to collateral branches of industrial enterprise resembles that in France. Austria, which produced only 10,000 tons in 1850, raised 80,000 tons in 1866-7; 30,000 of which were exported to England and France. While the average consumption of sugar in England for each person is 47 lbs., it is 17 lbs. in France, 12 lbs. in Germany, and only 3 lbs. in Austria.

Holland, Russia, and Belgium have also become large producers; Belgium alone producing 40,000 tons annually. But without entering into further details, I may summarize them by saying, that of all the sugar now annually made in the world (estimated at 2,320,000 tons), 639,000 tons, or above a fourth, is supplied by the Beet-root, which at the commencement of this century was not used for the production of sugar.

It is noteworthy that the astonishing progress in France has been achieved despite, not by the assistance of, protection; and opposed and persecuted as this industry has at times been by the colonial and shipping interest. Even at the present day, Beet Sugar manufactured in France pays 2 to 4 francs more duty than Cane Sugar imported from Bourbon and Martinique, and the same rate as sugar from Cuba, Brazil, and other foreign countries; thus showing the erroneous opinion of such able men as Liebig, M'Culloch, Leoni Levi, and many others, who declared that there was no future for Beet Sugar without protection. In the Zollverein and in Austria there is still an extra duty levied on Cane Sugar to favour the home product, but that protection has long ceased to be operative, as is proved by these countries exporting it, not only to the United Kingdom but also to France, although 2*s.* to 3*s.* per cwt. is incurred in freight, &c., by shipping it to the latter country. It is generally expected that at the present meeting of the German Parliament, or that of the Zollverein, an assimilation of duties will be established.

The prosperity which this united agricultural and manufacturing industry has secured on the Continent has attracted also much attention in the United States of America, Canada, and Australia. Companies have been formed even in California, and the Congress, although protectionist in its legislation, has admitted the required machinery duty free. The *Journal de Fabricant de Sucre* of last week states that a manufactory has recently been established in Iowa, for which the machinery has been imported from France, and 1,000 acres of land have been allocated to cultivate the root. I have shipped Silesian Beet-root seed to Adelaide and Hobart Town, but I fear that the heat and dryness of the climate in Australia will not make its cultivation a success. The press of Canada is constantly urging its introduction into that colony, and I have been consulted by representatives of that country on the subject.

Now, to what extent are we interested in these facts? During the season of 1865-6 we imported from France and Belgium alone 50,000 tons, and from other countries about 30,000 tons of Beet Sugar. Of the large quantity of refined sugar similarly obtained, at least 25,000 tons were made from Beet. For these purchases we paid nearly three millions sterling. But that money might have gone to native producers instead of to foreigners. In place of turning to the Continent, we might have turned to Ireland. Nay, more, the whole of the sugar consumed in these islands, representing a value of from twelve to fifteen millions sterling, might have been supplied by our own countrymen. We might have also become its exporters, and all the further vast outlay connected with its production might have enriched this, instead of other lands. In the year 1867, mangel wurzel was grown on 277,952 acres in the United Kingdom. Had that land been devoted to the cultivation of Beet, more than half of all the sugar needed for home consumption would have been produced, while the mere pulp of the Beet would have, in a great measure, replaced the mangel wurzel itself. Nor would the pulp have been the sole residue. We have seen that the 1865-6 harvest of Beet in France yielded 274,000 tons of raw sugar. But, in addition, there were 100,000 pipes (each containing about 120 gallons) of strong spirit, 60 over London proof (37 cartier or 93 centigrades), distilled partly from the root, and partly from the molasses; the value of which was £1,350,000; 20,000 tons of potash, valued at £500,000, were made from the refuse after distillation. When the juice had been extracted from the root, there remained 1,600,000 tons of pulp, estimated to be worth £1,000,000 as food for cattle, who devour it eagerly, and thrive on it even better than mangel wurzel, as it is concentrated, having lost the large quantity of water, especially when it is mixed with a small proportion of hay or oil-cake. Besides all this, the leaves and scum were used as valuable manure. Thus, apart from the other results already enumerated, the manufactured produce of that Beet harvest represented a value, without including the leaves and scum, of, in all, more than £9,000,000 sterling. Yet, the ground which yielded this imposing result was only 1-237th of the acreage of France—actually less than was devoted to the production of rapeseed. Nor do these figures show the entire benefits accruing to France. I have already mentioned some of these, but the list is far from exhausted; to fairly weigh them we must remember that as Beet is a triennial rotation crop, threefold the quantity of land annually used to produce the root is affected by its growth. The result is highly beneficial; for, used as a rotation crop, it prepares the soil, so that it need not be left fallow, and improves wheat so much that from one-fourth to one-third more is produced. Thus, the production of sugar increases the supply of bread and of meat; and these three leading necessaries of man's existence aid and stimulate each other. A conclusive proof of this is shown in the fact that in the Department du Nord more wheat is produced and a greater number of cattle fed than in any other department of France. Considerable quantities of both are exported to this country. In the various pursuits connected with the manufacture of sugar from Beet, above 100,000 French labourers find employment, exclusive of the 20,000 who are permanently engaged in distilling and of the large number employed by the farmers to raise the roots.

Now, foreigners who thoroughly understand the soil and climate best suited to Beet, and the methods of utilizing its products, agree that Ireland unites in perfection the elements of success. Many of our own countrymen have taken the same view, as was shown in 1851, by the establishment of the factory at Mountmellick, in the Queen's County, and in 1852, when an attempt was made to establish this industry at Maldon, in Essex; and recently, when an eminent refiner of London established a manufactory at Lavenham, in Suffolk, where he is at present vigorously prosecuting the enterprise. It is true that the attempts at Maldon and Mountmellick were abandoned; but these failures arose from want of capital and errors in management, not from the fault of the soil or the climate, as has, in the latter case, been acknowledged and explained in the London *Times* by the gentleman who acted as manager for the Irish Company. That errors should be committed in first attempts is but an ordinary misfortune. It occurred to Beet growers and manufacturers in France, in Germany, and in Belgium; yet in these countries success has since been achieved; and there is no valid reason to doubt that our attempts would have resulted favourably had the proper and indispensable steps been taken. I say this with the more confidence, because official testimony of the most reliable sort confirms the assertion, to which testimony time, on the present occasion, will not permit me to refer. I should not, however, omit some reference to the Report presented to Parliament by Sir Robert Kane, detailing the result of the exhaustive investigation conducted under his auspices at the Museum of Irish Industry, by Professor Sullivan and Mr. Gages, in which may be found evidence sufficient to satisfy the most sceptical.

Thus we see that the practical experience of foreigners, the convictions of Irishmen and Englishmen, and the authoritative testimony of public officials, are alike in favour of the views I hold on this subject. I may, therefore, speak with confidence, even had I personally no knowledge of the subject.

I did intend to place before you in detail some information respecting the best modes and the expense of growing the root, and of manufacturing its products in Ireland; but time will not permit me to do so. To those who feel interested in the matter, I may mention that in a pamphlet which I published early this year they will find a *resumé* of the various questions involved, and numerous statistical and financial details. But on this occasion I shall confine myself to the points which directly bear upon the practical business question—Shall we manufacture Beet-root Sugar in Ireland?

The Beet-root is a biennial plant, if allowed its full existence; but for practical uses it is an annual. It has many varieties, of which there are three descriptions cultivated for the production of sugar—the White Silesian, the Quedlinburger, and the Imperial. The *White Silesian* is peculiarly rich in saccharine matter. It is slender and tapering, and shows very little above ground, penetrating about twelve inches into the soil. The depth to which it grows renders it unsuited to a clayey tenacious soil, but it prospers in rich, light, loamy earth, easily penetrated by water, with nutritious elements at a good depth.

The *Imperial*, which, from its richness in saccharine matter, may be called "the Queen of Beet-roots," is in shape like a pear, and its leaves, like those of a cabbage, are crisp, rough, and fatty. When fully ripe, the stalks of its leaves near the heart are of a rose colour. The *Quedlinburger*, growing to a greater size and weight, and ripening a fortnight sooner, does not yield as much saccharine as the Imperial. Its stalks are of a reddish tinge. It will flourish on poor land, and in France is extensively cultivated. Of the three, I should recommend the Imperial; but each has its merits, and deserves a fair trial.

Great changes have been effected in the quality of the Beet-roots, and in the quantity yielded by the soil since it first became an important agricultural product; and these have evinced steady improvement. Indeed, had this not been so, the rivalry of cane sugar could not have been overcome. However, on all sides advance has been established; and chemists are confident that the maximum has not yet been nearly reached. I will speak of this presently, but will mention here that while Chaptal counted, in round numbers, twenty tons per hectare (two and a half acres), later on, Dubrunfault, twenty-four tons; and more recently still, Dr. Sace, forty tons; in the north of France a hectare often produces fifty tons; but forty is considered a fair average. It is on record, however, that M. Dargent, Department de la Seine, produced twenty-eight tons of superior roots from an English acre—a yield which Vilmorin, in France, and Knauer, in Germany, encourage us to believe may, in time, be generally realized; and in experiments made in Ireland this expectation has received great encouragement. At present the statute acre in France yields sixteen to twenty tons; but in Germany economical and fiscal considerations leading to a different treatment of the soil, only twelve to fifteen tons are raised. The quantity of saccharine obtained, however, is almost the same per acre, as the root cultivated in Germany is very rich, though small.

Since Beet has become such a valuable crop, land in the districts where it grows has doubled in value. In Belgium, the Zollverein, and France, it is worth from £2 to £4 per English acre; and labourers receive from 1*s.* 6*d.* to 2*s.* a day, and mechanics, 2*s.* 6*d.* to 3*s.* In Austria the rates are somewhat lower, but the dear money, bad roads, and inferior coals neutralize this advantage. The importance of the sugar industry on the Continent may be estimated by my hearers by the fact that in France one weekly journal and one monthly are published entirely devoted to this branch of industry. In Germany and Austria similar periodicals exist, and a mass of literature is constantly issuing from the press on various subjects relating thereto. [Copies of the two French journals lay on the table.]

At what cost Beet-root could be grown in these islands is a question which Sir Robert Kane and Professor Sullivan investigated with care and acuteness. I have examined their figures, which appear to be correct, and I am prepared to accept their dicta on the subject. The expenses—rent, taxes, labour, &c.—would not differ much from those abroad. But numerous experiments have placed it beyond doubt that our soil yields heavier and better roots than that abroad. With fair cultivation, the ordinary yield would be twenty tons per acre, if not more; good ground, well cultivated, would produce thirty tons. I have dwelt thus long on the agricultural and manufacturing questions of the Continent, from my wish to urge upon you the fact that in all the conditions which govern the growth of the root, Ireland is most advantageously situated.

Many years ago M. Payen asserted that 5,000 tons of Beet-root would yield 300 tons of pure sugar, and sixty tons of molasses. At present this average has been fully reached in France, six to seven per cent. of pure sugar being obtained ordinarily, according to the richness of the root, the weather during the season, or the manufacturer's skill. Thus, in 1846, the French average was only five and a half per cent., but seven per cent. in 1857, and in 1865, eight per cent. As a rule, 100lbs. of French Beet yield 12lbs. of sugar. M. Vilmorin, a French physiologist, known by ameliorations he has effected of various industrial plants, intimates his having grown a species of Beet-root containing twenty-four per cent. of saccharine matter; and going on further, he stated that of this rich root he could obtain about sixty tons per hectare—i. e. twenty-four tons per acre.

Eminent chemists assure us that the whole of the sugar in the Beet may be crystallized, and it is in every essential respect similar to that extracted from the cane. Indeed, Ure states that cane and maple sugar are, in cohesive quality, surpassed by that of the Beet, since larger and finer crystals are obtained from the latter. This is particularly so in the article of candy, of which, if made of Beet, as in Belgium, the crystals are larger and better defined than those which, in Holland, are made from cane sugar. This opinion is also held by Baron Liebig. Perfectly pure sugar made from Beet cannot be distinguished from the product of the cane, though, in its imperfectly purified state, it can be easily detected by both taste and smell. Some English refiners, especially in London, were prejudiced against the article when I first introduced it to their notice some years ago. They considered it inferior, and would purchase it only at 1*s.* to 2*s.* less than the price of cane sugar. But those who have fairly tried it now admit that there is little difference; nay, further, that being entirely free from sand and of stronger crystals, it is preferable to unclayed Brazil, Cuba, or Manilla; and when refining, passes through the filters with greater ease. Thus, of the whole quantity of sugar last year produced in France, not less than one-fourth was pure white crystals above No. 20, *though it did not pass through the refiner's hands;* and of the remainder, about one-fifth was from No. 15 to No. 20—a very pure quality. The Scotch refiners have, for some years, largely used Beet sugar. They will pay somewhat higher prices for it than for cane sugar, though, unfortunately, the differential duties in this kingdom have made it the interest of our refiners to purchase chiefly the common qualities, in which there is often an undue proportion of molasses, mother liquor, and other uncrystallizable matter. Nevertheless, its use is rapidly increasing in England and Scotland. Prejudice has all but disappeared, and it may be asserted without hesitation that whatever quantity native manufacturers may thereafter produce will find a ready market at prices equal to those of cane sugar.

I have here on the table, for your inspection, samples of various qualities of sugar, also the other products of the Beet.

The expense of manufacturing the root was examined with great care and minuteness by Professor Sullivan, who, in his pamphlet published in 1851, elaborately stated the result of his inquiries, including the cost of machinery then in use in a Prussian establishment. Taking the produce of the root at only five per cent. (though seven per cent. was then obtained in Germany), and having made all proper deductions, including ten per cent. for wear and tear of machinery, he showed that white sugar might be produced in Ireland for £21 18*s*. 3*d*. per ton. I have examined his figures, which I think were trustworthy; but as extensive changes have been since then effected, the following balance-sheet is what I prefer to lay before you. The figures come from reliable sources, and represent the present state of things in France.

Expenses and Returns in manufacturing 20,000 *tons of Beet-root, the yield of Sugar being only* 6½ *per cent.*

EXPENSES.

20,000 tons root, at 16*s*.,		£16,000
General expenses, charcoal, wages, and management,		9,000
Interest on capital invested in buildings and machinery, say, five per cent. on £20,000,		1,000
Interest on outlay during six months' season of purchase, manufacture, and sale,		600
Wear and tear of buildings and machinery; say, ten per cent. on £20,000,		2,000
Ground rent of land (or interest, taxes, insurance, lighting, &c.),		1,000
Bags, barrels, and cartage to store, rail, or canal; say, carting 1900 tons sugar and molasses, at 2*s*.,	£190	
Bags for 1300 tons sugar, at 6*s*.,	390	
Barrels, 600, molasses, at 15*s*.,	450	
		1,030
Profit,		7,570
		£38,200

RETURNS.

1,300 tons sugar—26,000 cwt., average, at 24*s*.,	£31,200
600 tons molasses—12,000 cwt., at 5*s*.,	3,000
4000 tons pulp (20 per cent. of root), at £1,	4,000
	£38,200

(*a*). The spent charcoal and scum of the syrup will also have some value.

(*b*). If the molasses be distilled on the premises a second profit will be realized and expenses lessened.

The profit thus shown is 24¾ per cent. on the outlay. Each additional one-half per cent. of sugar will add £2,400, or 7½ per cent. more profit. Thus, if 8 per cent. is extracted, the profit will rise to 48 per cent. Last year a Company in Valenciennes paid 30 per cent. to its shareholders.

That more than 6½ per cent. may be expected in Ireland is certain. To look on 6½ as an ordinary return is to take no account of the peculiar advantages here possessed, or of the progressive manufacturing improvements which are gradually but steadily increasing the quantity obtained everywhere. To illustrate the latter point, I may mention that when I was in France a month since, I was invited to attend a meeting of gentlemen interested in Beet, summoned to witness the working of a contrivance by which a large saving of time and labour is effected in the extraction of the juice from the rasped root. As I have not entered into a detailed account of the various manufacturing processes, I need not enlarge on this. But I may say that the meeting unanimously agreed that the proposed improvement would be successful, and that it would effect a *material* saving of labour and machinery, reducing, in fact, the expense at that point to one-fourth of what it was before, besides shortening the time required for manufacture. This is *one* element, and a continually improving one in the calculation. Another is found in the fact that even 8 per cent. of sugar has long ceased to be a maximum; that no more than 6½ per cent. is usual in France at present is certainly true, for which reason I have assumed it as a probable Irish average. The Germans, cultivating a smaller root than the French, long since passed to 8, 9, and even 10 per cent.; and whereas in 1836 they required 18 cwt. of roots to produce 1 cwt. of sugar; in 1841, 16 cwt., in 1846, 14 cwt., and in 1854, 12½ cwt. sufficed; whilst at present 11½ cwt. generally produce 1 cwt. of sugar. Even in 1851 the product of raw sugar at Waghœusel was often 8 per cent., since when the results have greatly improved everywhere. Now, in these islands the soil yields, with efficient culture, larger and better crops than does that of either Germany or France. The climate, too, is better suited to Beet; we may therefore calculate with confidence on 7½ per cent. as a moderate yield in our case; and alter the balance sheet to that extent. Nevertheless, I do not urge this. I am content to direct attention to it; meanwhile resting my argument on the fact that even 6½ per cent. of sugar obtained by the manufacturer will leave him a profit of 24¾ per cent. on his outlay, after allowing interest on capital at 5 per cent.

This prospect is, I take leave to submit, one which would amply justify the commencement of this enterprise in Ireland; and the question, therefore, may well be asked, Why does Ireland not cultivate Beet-root? To this I can see but two plausible objections, but neither of them will bear examination. The farmer may say: "The price you quote does not tempt me to change from the crops I now raise, and were I to grow Beet, Who would purchase it?" The manufacturer may say: "I cannot depend on obtaining Beet when I am ready for it."

It is undoubtedly the fact that success can only commence in the perfect concord of the grower and the manufacturer. But surely this difficulty is not so serious as to be insurmountable. Has self-interest lost its power? Have contracts no longer a legal value? Or, putting these out of sight, is it not possible to adopt measures which will place both interests under one direction? I think this difficulty—if it deserves the name—which is met and conquered in every department of commerce, and which no longer causes any confusion in the Continental Beet districts, nor in the flax districts in the North, need not be dwelt upon.

As to the cost of producing the roots in Ireland, and the price at which they can be sold by the farmer after leaving him a reasonable profit, many gentlemen present will be better able to form an opinion than I can pretend to be. With the great advantages that this country possesses for the growth of root crops, I have been assured by many leading agriculturists of Ireland that the prices paid on the Continent would be fully remunerative here. The conditions of soil and climate are indeed, as already stated, pre-eminently favourable in Ireland.

The average of rain, whilst equal to that in the North of France, extends over a greater number of days; the dull foggy atmosphere rarely suffers extreme heat or extreme cold; the soil in every direction is just what Beet growers seek. During the experiments made in various parts of the island by the noblemen and gentlemen who assisted Sir Robert Kane, the natural result of these advantages was realized in a weight and a quality of root such as have never been surpassed anywhere. In commencing to grow it now, our farmers would be aided by the accumulated experience of their Continental neighbours. Mr. Duncan is paying 20*s.* for roots delivered at his factory in Lavenham, and tells me he can well afford to do so.

Now, what the exact profit obtained by growing other crops may be in Ireland I will not undertake to state; but the profit to be made from Beet seems to me to be satisfactory. Yet this does not represent the whole advantage accruing. For it is only reasonable to calculate here on the established truth that wheat or oats following in rotation are remarkably good and plentiful. It is equally well established that cattle fed on Beet pulp, or on land manured with its refuse, will yield better and have more milk, and are more valuable when sold for food; and these considerations must be fairly weighed before we finally appraise the advantage of this branch of industry. When this is done, I believe no farmer will question its great value; as, I am confident, no farmer will fail to feel it in the largely increased profits of his farm. In selling the root, the return of a certain quantity of pulp at a given price is generally stipulated. But is Irish soil fully occupied? Is Irish labour in much demand at home? In the North they may be; and there the wealth, the energy, and the happiness of this island are most displayed. But the West and the South tell a different tale. There land is available—there labour is driven to emigrate—there, where the introduction of the Beet industry would best succeed, such undertakings are most needed. *Then why not create there* ANOTHER

NORTH? *Why not raise up* IN BEET *a worthy rival of* FLAX? Why not, while Ireland becomes more and more a grazing country, and its wheat crops prove inferior to those of England, introduce *what, of all possible aids, will be most beneficial both to the cattle and cereals?* It may be done. *It should be done.*

Does not Ireland, ever restless, ever energetic, but ever dissatisfied, with her abounding genius and ambition, need those manufactures, which ever lead to prosperity, to enlightenment, to true liberty, and to intelligent patriotism? And does not this Beet-root, in its various and dissimilar, yet uniformly useful applications, furnish one of those unpretending, but mighty levers by which provinces, and even nations, have been redeemed and regenerated? I do not say that till it is used many parts of Ireland will remain poor and discontented. But I do assert, that its judicious introduction will not only add to Ireland's wealth, but will also increase the happiness and the loyalty of her sons. I do assert that whoever, be he peer or commoner, or only the director of some joint-stock company—whoever, by his enterprize, patience, and skill, succeeds in naturalizing this industry here, will not only benefit himself, but also will deserve well of his country. I repeat, it *may* be done—it *should* be done.

The magnitude of the industrial interests which would thus be created in a few years is a matter of national importance. Were 400,000 acres of land each year planted with Beet, thrice that extent, say 1,200,000, would thereby indirectly be brought into the highest state of cultivation. This would in itself be a social revolution. But 400,000 acres alone would show this annual result, viz.:—

From each acre 20 tons roots, yielding 7½ per cent. of Sugar, 12,000,000 cwt. at 24*s*.	£14,400,000
20,000,000 galls. spirits, 60 per cent., at 2*s*. 3*d*., .	2,250,000
2,000,000 tons pulp at 20*s*., ...	2,000,000
40,000 tons potash, at £25, ...	1,000,000
Leaves, &c., from 400,000 acres, at 20*s*., . .	400,000
Scum and refuse, ...	100,000
Annual value of Beet products, ...	£20,150,000

Is it not worth while to risk temporary disappointment in producing such a result?

I assume, then, that we may look on this as possible and as desirable. I take for granted that if a well-concerted scheme of operations be devised and executed—if there be provided good management, perfect machinery, able workmen, and sufficient capital—if the farmers be ready for the manufacturers, and these for the farmers—if, when all is at work, one quarter or one-tenth the patient faith in the future of this enterprise be exercised in Ireland which was exercised in France and in the Zollverein before full success came, a great, lucrative, and noble development of your national resources will be effected.

I now pass to my last point—viz., how business men, desirous to make a profit by their exertions, can best proceed in prosecuting this undertaking to a successful issue.

Skilled workmen, to overlook the crowd of labourers, and attend to the more important duties, may be obtained from Germany, as they now are by most of our sugar refiners. There is probably no great refinery in these kingdoms without such employees, who perform their duties with admirable diligence and skill. The remaining labour is abundant.

The machinery, it is almost needless to say, England can provide. Already our machinists will willingly take the order, and promptly do all that is needed. It can be made by them as cheaply and as well as in any foreign country.

Of capital there would be no lack, without English aid; though, if sought, this could easily be obtained. Many of my friends in England are so well satisfied as to the great future of this branch of industry, that they are prepared to liberally provide capital to aid any well-devised scheme that may be placed before the public. Ireland, however, has many sons well able to supply this element of success.

There remains the difficulty—how to secure concord between the farmer and the manufacturer, so that roots of the desired quality shall be forthcoming. And an understanding with the Customs' authorities would be necessary. As regards collection of the duty, Mr. Duncan finds, and I have ascertained, that the authorities will do all in their power to lessen difficulties. The Company organized in 1851 found the necessary steps involved but slight expense and inconvenience. Whether the duty be collected on the root, on the juice or syrup, or on the manufactured sugar, the Government would doubtless see that the arrangements made were such as would cause least trouble to the manufacturer and least expense in collection. Mr. Duncan has been treated in the most courteous and liberal manner by the authorities.

Arrangements for purchasing the roots must originate with the manufacturer or distiller, since until a market presents itself, farmers can scarcely be expected to sow. Various plans are open. If only the large, low quality roots are grown for distillation, spirits fully equal to what grain yields can be produced at a smaller cost. As distilleries are familiar to the Irish mind, this course may be attractive. But if sugar be chiefly sought, the juice can be extracted from the roots in small manufactories erected in central positions, prepared for removal, and then conveyed to refineries at a distance for conversion into sugar. In this case, or should large and complete manufactories be adjacent, the farmers must pledge themselves to furnish a fixed quantity of roots, or at all events to apply a certain number of acres for that purpose. The manufactories may be erected by private enterprise, or by companies of farmers, who thus unite two profits, or by independent companies altogether.

On the Continent manufacturing companies abound; and where these do not consist of the farmers interested, it is not unusual for them to lease land, grow such roots as are known to be most suitable, and by pursuing a uniform system, secure excellent results. In Austria the great land magnates enter the field, and combine farming, distilling, sugar making, and cattle feeding. Were one of the many wealthy landowners in England or Ireland to adopt this course, he would enormously benefit himself, as well as the surrounding population. The undertaking is one in which these gentlemen are eminently qualified to take the lead. Their social position is allowed to have duties as well as privileges. Their influence over tenant farmers is great. From the wealthy Irish proprietors much may be looked for. And I am not without hope that the example of the Hungarian and Austrian magnates to whom I have alluded may yet be imitated here; that from your ranks may emerge some far-sighted man who, by his establishment of this great industry in Ireland, will secure for himself and his descendants advantages akin to those seen at Saltaire, in the Bridgewater Canal, or in the Cardiff Docks.

Or a commencement can be made in a partial manner and on a small scale, by establishing, say near Cork, Waterford, and Wexford, manufactories, where the roots can be purchased from the neighbouring farmers, the juice extracted and boiled, and then forwarded to Dublin, Liverpool, Bristol, London, or the Clyde, where the refiners will purchase it. In this case a small capital will suffice, and when the farmers learn to steadily grow the roots, an impression will soon be made which may induce similar enterprise on a larger scale. There is much to be said for division of labour in preference to ill-considered attempts to grasp more than can well be accomplished under a single management. Perhaps, too, in this case, as in many others, we should learn to walk before we try to run.

Yet, for many reasons, bolder action may be necessary in Ireland, so that unity of management should control, to some extent, the farming and the manufacturing operations altogether. It is not improbable that ere long advances in mechanical ingenuity will enable refined sugar to be manufactured direct from the root, without the intervention, as at present, of a refiner. It has already been attempted in France with considerable success. Should this be so, the erection of a complete manufactory adjacent to the farms will become eminently requisite. But apart from this, the facts are so clear, the needs of Ireland are so great, the tide of legislation and of national sympathy has turned with such force in favour of this island, that I see no valid objection to the immediate formation of a Company, which conducting all the manufactories and refineries, and able, in the command of capital, to *wait* for the certain lucrative result, should give to the world one more proof that Irishmen have administrative and executive ability, and confer on widely extended districts the physicial, social, and intellectual advantages which should spring from such an enterprise.

I wish I could speak at length on the fact. Whilst labour would thus be in greater demand, its market would not be disorganized. Employment would be furnished to large numbers at the exact period when most required; for the Beet harvest commences at the termination of the wheat harvest. Thus there is no interference with that which most demands abundant labour. Its manufacture into sugar, &c., goes on during winter—the season when most of the artisans connected with the building and other trades are unemployed. Thus, these could practise two handicrafts, as they do in France and Germany, whose Beet districts are almost unscourged by pauperism. There the approach of this harvest is hailed with general delight, just as in the south of France that of the vintage excites universal activity. As one medium of support passes by another presents itself, and throughout the year is witnessed what monarchs, statesmen, and philanthropists most love to see—a contented and prosperous community.

I could also say much about the social aspect of the question. The spread of this branch of agricultural and manufacturing industry being by its very nature confined to the country, it takes from young people the dangerous necessity of resorting to large towns, which, when in unrestricted action, often produces disease, poverty and vice. The Beet factories are scattered at intervals of a few miles over the districts where the root is grown. Population, therefore, does not accumulate in a small space. Land for the erection of dwellings does not become so valuable as in large towns; consequently, in place of small, unhealthy habitations, numerous large villages furnish comfortable accommodation. The result is reduction of poor rates, spread of intelligence, increase of cheerful contentment, and diminution of social jealousies and wretchedness.

In a matter of this sort, I am sure you will not misjudge me if I urge with earnestness the very great importance of some action being promptly taken. Such a result of my appearance here to day will afford me sincere pleasure. From such an audience as have listened to me I am unwilling to expect less.

Examine this subject, gentlemen. Inquire minutely; test my figures jealously; make allowance, if such is required, for any important considerations I may have omitted. But whatever you do, however you may finally decide, do not allow it to again drop out of sight, as has been the case for many years past. Had Frenchmen and Germans remained supine, or been cast down by temporary failures, they would not have to-day attained such prosperity as that which I have described; had doubts such as have deterred you from planting Beet-root on your soil operated everywhere, how small would England and Scotland have been? had your countrymen in the North been less patient, courageous and wise, where would the Flax and Linen industry be to-day?

All that has been done elsewhere, and more, you can do. On such an assembly as this, representing the science, the wealth, the enterprise, the patriotism of the metropolis, I hope my appeal will not fall in vain. And I therefore conclude, by venturing to believe that, though in the natural course of events the active business life which has familiarized me with this subject must terminate ere long, I shall, before it closes, be able to congratulate you on the successful establishment of the great undertaking which I have thus commended to your thoughtful attention.

At the conclusion of this paper, MR. BARUCHSON laid on the table numbers of two out of several periodicals devoted on the Continent entirely to the interests of this manufacture. One was the "Journal des Fabricants de Sucre," published bi-monthly at Paris; and the other, "La Sucre Indigène," published monthly at Valenciennes. He also stated that the sugar-refiners ordinarily used water to dissolve the sugar, but that Mr. Duncan, who had a beet sugar manufactory in England, used the juice of the beet itself for that purpose, which was a great advantage.

MR. SPROULE said that as he was the local manager of the Irish Beet Sugar Company, he might be expected to make some observations on the subject. He would not, however, enter into the discussion further than to state, that the failure of the operations at Mountmellick, commencing in 1851, arose entirely from mismanagement, a detail of which appeared in a letter in the London *Times* of 11th February last. If the same system had been pursued in France, failure would have resulted there also. The introduction of beet sugar into Ireland was opposed to Mr. Baruchson's private interest, but Mr. Baruchson, nevertheless, not only appears as its advocate, but was ready to join any effective movement for the purpose, as well as to secure pecuniary aid from his friends, should such be required. Sir Robert Kane's Report on the subject paved the way for the attempt to be successfully made in Ireland.

The Chairman, SIR ROBERT KANE, praised Mr. Baruchson's paper, and invited discussion on the subject.

MR. JAMES HAUGHTON mentioned that Mr. Monsell, M. P. for Limerick, lectured at Limerick two years ago on Irish industries, and spoke of beet sugar in Ireland. But it seemed to Mr. Haughton that the information supplied both by Mr. Monsell and Mr. Baruchson was defective concerning the protection duties in France. Many people thought that beet sugar could not succeed without protection, and before any safe calculation with respect to the probability of success in Ireland could be made, it would be necessary to know if all duties on foreign sugar were taken off in France, and whether the results quoted by Mr. Baruchson arose before or since the removal of the duty.

SIR ROBERT KANE asked Mr. Baruchson to reply to the question.

MR. BARUCHSON said that the duty on colonial sugar in France was 1 per cent. less than that on cane sugar, to compensate for the expense incurred in freight, &c. All other foreign sugar pays the same duty as beet sugar, but it was the present intention of the French Government to equalize the duties on all sugars. The machinery at Mountmellick Manufactory was erected without judgment, and worked out of season; no sufficient supply of beet could be obtained, the price of sugar fell, and the undertaking was abandoned in despair. But had its promoters waited two years more, they would have realised a fortune in spite of all mismanagement, for the price of sugar which was 30*s.* per cwt. in 1852, rose in 1854 to 50*s.* per cwt.

MR. WALDRON thought that Mr. Baruchson's suggestion that the expressed juice should be sent to large manufacturing towns to be refined, was a very practical one. At the French Exhibition he noticed a machine for expressing the juice, and intended to purchase one for the purpose. He applied to a Scotch sugar refiner, who said that the Irish climate was so damp that too little saccharine matter existed in the root to make it worth while to try the experiment. Farmers would not grow beet without some idea of the probable profits; but he thought that gentlemen with large farms might, for the sake of their country, try the experiment, and send the concentrated juice to England, if the chances of success appeared to be favourable.

MR. JOHN BAGOT thought that the real cause of the failure of the Mountmellick experiment arose from the want of a sufficient supply of roots. The experiment was started on too large a scale, and then failed for want of material; for neither labour capital, or machinery, were wanting for its success. In France, a few small farmers set up a manufactory, took small shares, and agreed to plant a certain quantity of beet, and supply so much annually. With the pulp, they fed their cattle; they received returns from their small capital, and the supply of roots was kept up. When large capitalists found the undertaking succeeded, larger manufactories were established. It would be likely to succeed if Irish farmers were to agree to establish small manufactories, and preserve and keep up the supply of roots. In the first start, the difficulty would be to get a return.

Mr. Dix Hutton referred to Mr. Baruchson's pamphlet, read at a Social Science Meeting, held at Belfast. It was most important to raise up branches of agriculture suitable to Ireland, but it was necessary that the facts should previously be carefully scrutinized. Facts were against Mr. Baruchson's assertion that beet manufacture on the Continent flourished in spite of protection. It was encouraged by Napoleon's protective system. But it must not be supposed that the manufacture would not flourish without protection. Manufactories which were formerly aided by protection in Prussia can now dispense with it. Beet sugar is now on a footing with foreign sugar. Holland has sugar-growing colonies which it is her interest to protect, but out of 20,000 tons used in Holland last year, one-third was beet sugar; and if beet sugar is successful in Holland, it does not want protection. But it appears to be doubtful whether beet sugar could be produced in Ireland at a profit. In 1852, Lord Talbot de Malahide found the cost of cultivating beet was £13 5*s.* 8*d.* per acre; and £13 per acre being a fair average return in France, it appeared that loss rather than profit would result from the undertaking. The Royal Dublin and Agricultural Societies should form committees to institute inquiries among farmers at home and abroad. A Parliamentary Commission on the subject would also be desirable.

Professor Sullivan rose to speak on the three principal points which had been alluded to. 1st. Protection in France. Beet industry practically commenced in 1825; but in the ten years, from 1835 to 1845, it increased so rapidly as to alarm the colonial and shipping interests. At first, beet sugar paid no duty, but afterwards a gradual equalization of the duty was effected. To make protection effectual, it is necessary that the inhabitants should consume more sugar than they could produce. Between 1842 and 1849 the excess of produce over consumption amounted to 30,000 tons, and the price of sugar consequently fell. At present, allowing for duty and local differences, the retail price of sugar is the same in France as here. From 1848 to 1852 the sugar question continued to be agitated in France; and ultimately it was decided to protect colonial sugar. It had been asked, why should we manufacture sugar at home, when tropical sugar might swamp it as soon as the inhabitants of the tropics were civilized? The answer to this lay in the success of the sugar manufacture on the Continent. In the present year, 200,000 tons were manufactured in the Zollverein. 2nd. As to the chemical question, the government voted £3000 for the promotion of the flax industry in Ireland, and at the same time published a pamphlet tending to prove that flax would not grow in the country at all, or, at least, not in three provinces of Ireland. It was said that Irish sugar would prove uncrystallizable. The same was said in France in 1849, when the Commissioners had actually seen the sugar extracted before them. The proportion of sugar varies with the size of the root, and is generally larger in small roots. The proportion of sugar in the roots has nothing to do with the proportion of sunlight. If the plant was well cultivated, it would, no doubt, grow as well in Ireland as in France or Belgium. At present, 14,000 to 15,000 tons of sugar are now annually produced in Belgium, where none was formerly produced. Mr. Hutton was mistaken as to the probable expense. No doubt, if the same system of high farming was adopted as by Lord Talbot de Malahide, the expense would be similar. When Sir Robert Kane's Report was drawn up, the farmers were asked the price at which they could afford to grow beet, and they all made rambling statements. Lord Talbot de Malahide and Mr. Dargan were the only people who could furnish any precise information on the subject, and their returns were the lowest of any. 3rd. Much blame had been laid on the promoters for the failure at Mountmellick, but the money spent on it was at least spent honestly. However, everything was conducted so injudiciously that failure was inevitable. The worst spot in Ireland for growing beet was selected. An old mill was taken, half a mile from the canal. The machinery used was chiefly old expired patents of 1834 and 1835. It was admirably fitted for consuming its own steam, but for nothing else. The engine consumed 20-horse power of steam, and produced 8-horse power. How was success possible under such circumstances?

PROFESSOR CAMERON. Beet root should be looked at in an agricultural point of view. It is not generally grown in Ireland, but a friend of his grows it for feeding stock. He began to do so, when it was usual to convert barley into malt for that purpose, and he thought beet would answer as well. He now regularly grows three or four acres of beet, and could procure twenty-six tons of roots on an average, which is equal to that of Germany or France. He takes no particular precautions, and his beet is not inferior to Continental. The soil of Ireland was especially adapted for roots of all kinds, and there would, doubtless, be a large return both of roots and the saccharine matter in the root. Mangold-wurzel, a root very closely allied to beet, produced the largest roots, and the largest return per acre in Ireland. It had been stated on the premises of the Royal Dublin Society that a farm in the neighbourhood of that of Lord Talbot de Malahide yielded from 85 to 120 tons of mangold-wurzel per acre. Nothing was required to start the industry in Ireland but enterprise and capital. It was a great advantage that the beet harvest would not commence till the corn harvest was over; and, in consequence of the mildness of the Irish climate, the roots could be left in the ground a month longer than on the Continent, and would be proportionably richer in sugar in consequence. Beet was a biennial, but an annual for all practical purposes of cultivation.

MR. GOODE said he did not know if there were any farmers present; if not, it was to be regretted, as they were most interested in the movement, and after former failures it would not be easy to gain their confidence. Farmers of all classes had adopted a rotation of some sort or other—it might be a vicious and destructive one, or an ameliorating and improving one, which took years to get into; they now run in a groove like a railway carriage which they could not get out of, and any attempt to displace any crop in that rotation, and substitute that of sugar beet, might derange the system and destroy its equilibrium. All continental chemists and manufacturers of sugar from beet insisted on the necessity of producing roots of small or medium size, as they contained the greatest percentage of sugar, and if grown to a large size by the aid of dung or other putrescent manures, they secreted salt in excess, which, being deliquescent, prevented the saccharine matter from crystallizing, and the product ran into molasses. Professor Sullivan, in the elaborate experiments instituted under the auspices of the Government, first on a small and subsequently on a manufacturing scale, the reports of which were presented to Parliament, confirmed the continental reports, and preferred the small roots to the large ones. Dr. Cameron has referred to the extraordinary produce of mangels near Clontarf; but it must be recollected that those roots were produced for cattle feeding, and not for the manufacture of sugar, which are altogether distinct things. Mr. Duncan, of Mincing-lane, London, early this season, had a meeting of farmers at Lavenham, and offered 18*s*. per ton for sugar beet, and if they engaged to cultivate 100 acres, promised to erect a manufactory, where the roots would be rasped down, the juice expressed and boiled down till the syrup contained 56 per cent. of sugar; then casked, and sent to his refinery in London; but he stipulated that the roots should not exceed 3½ lbs. Much had been advanced at to the weight per acre that could be produced. Now he, for other purposes, compiled some tables several years ago, and he found that drills, 28 inches apart, which is the usual distance, and for horse culture they cannot be made much closer, and the roots 12 inches apart, centre from centre, the produce of roots of 1 lb. each would be 13½ tons; roots of 2 lbs. each, 27 tons; and roots of 3 lbs. each would amount to 40½ tons per Irish acre; but in this last case that quantity could not be produced at the distance named. Now, roots of 3 lbs. or 3½ lbs. each would be large ones. He this day saw some purple beet, which for size, shape, weight, and clean growth, without offal, resembled the sugar beet in its normal state when cultivated for the manufacture of sugar, and they weighed exactly 2 lbs. each, and, as a practical man, he was convinced, having cultivated the plant frequently, that the root cannot be grown on dung without injury to its secretion of saccharine matter. He was aware that one of the many causes of the failure at Mountmellick was the low price offered for the roots by the Company—first 12*s*., and then up to 15*s*. per ton. Now those prices could not pay the farmer, and Colonel Dwyer (and others) wrote to the office with which he was connected, and said that his pigs would compete with the Company at those prices, and he knew that within five miles of Dublin it would cost 5*s*. per ton to deliver them, which would leave but little to pay the cost of cultivation. The consequence was, that when the farmers produced the roots they in many instances refused to sell them at less than 20*s*. and 25*s*. per ton; another was that the Company would not receive the roots when the farmers wished to deliver them, so that in storing much loss was sustained by wounds, bruises, and heating, all of which being inimical to the production of sugar, compelled the Company to reject them, and as many farmers suffered great loss by throwing the roots on their hands, they will not be induced to grow the crop again without a guarantee as to remunerative prices, and unless they are relieved of the burden of storing them till it may be the convenience of the Company to receive them. He must not be understood to have any desire to throw cold water on this great industrial movement. He was well aware that sugar beet can be produced in Ireland as rich in saccharine matter as it can be in any other country; but it requires peculiar treatment and management; still by care and forethought a place may be found for it without creating any disturbance by a judicious extension of existing rotations.

Sir Robert Kane then called on Mr. Baruchson to reply.

Mr. Baruchson said that the sugar manufacture was established in France by a protective duty. Since protection ceased, the production has received a great impetus. In France it was not carried on at first by small farmers, but by rich private individuals. In Brunswick it was established by associated farmers. The last crop in France yielded 50 tons per hectare. Stable manure and rape cake were largely used for manuring beet in France. Beet was there grown as a rotation crop every three years, and much better corn was yielded after it. French producers had three modes of disposing of their sugar—it might either be exported, with no drawback, placed in entrepôt, where it would pay regular duty, or manufactured in bond, and then exported. When sugar was for export, a sort of passport was given. Holland is as moist as England, and has very fine sugar colonies, but the manufacture of beet-sugar is increasing. Belgium now produces 40,000 tons. Great benefit would result to farmers from employing beet as a rotation crop; and it would greatly improve the land.

Sir Robert Kane observed that he had at a former period conducted, with the assistance of Professor Sullivan and Mr. Gages, some investigations on beet cultivation in Ireland. The results were fully as favourable as the average of those on the Continent in all particulars, and if there was any difference it was in favour of Ireland. There was no apparent reason, or insuperable difficulty, why the sugar manufacture should not succeed in Ireland. The causes of the failure of former experiments were difficult to investigate, and disagreeable when found. The roots can be most advantageously produced in this country, and the chief difficulty to contend with is the formation of too favourable expectations at first. In all these undertakings large profits were expected at the commencement, and risks and casualties were overlooked, and great disappointment was therefore felt if large returns were not received, which could only be obtained by continuous and carefully conducted operations. Patience and diligence, and the avoidance of too great expectations being formed at first, were necessary elements of success.

XXXIV.—*On the Ailanthus-feeding Silk-worm (Bombyx Cynthia), and the probability of its easy Naturalization in Ireland.* By W. F. Kirby, M. E. S., Assistant in the Natural History Department of the Royal Dublin Society.

[Read Monday, November 16, 1868.]

At the beginning of this year (1868) the Royal Dublin Society authorized experiments to be made respecting the rearing of silk-worms in Ireland, and the management of the Ailanthus-feeding Silk-worm was entrusted to me. The result has been, on the whole, satisfactory, especially considering that it was the first experiment in the country, and I am now about to lay the details before the Society.

A hundred young trees of *Ailanthus glandulosa* were procured from Dr. Wallace of Colchester (who is in the habit of rearing the silk-worm in large quantities), and of these a part were planted in my garden in Upper Rathmines, and the remainder at Glasnevin Botanic Gardens. The tree grows so rapidly, that by the middle of the Summer many of the plants were covered with the most luxuriant foliage.

It was desirable to delay the commencement of the experiment as long as possible, in order to give the trees a longer time to grow, and also to lessen the risk of the moths appearing in the autumn, as the eggs cannot be preserved through the winter, because they hatch in about a fortnight after being laid; and the insect ought, therefore, always to pass the winter in the cocoon, and emerge in the early summer.

On these accounts I did not procure any eggs from Dr. Wallace till the 23rd of June; and these commenced to hatch on the very next day after I had received them, and by about the 26th the greater number were hatched; I then procured some of the thinnest black muslin, according to the directions which I had received, and pinned the eggs in five small paper parcels, on five trees, inserting a leaflet into each parcel, and enclosing the whole in small muslin bags. The newly-hatched larvæ were almost black at first, and rather over $\frac{1}{8}$ of an inch long; but about the 3rd or 4th of July, after the first month, they became yellow, with black dots, and looked, in fact, very like the saw-fly larvæ, which are so injurious to the gooseberry trees. While they are small, they crowd together so much that I have sometimes counted as many as twenty on the under surface of a single leaflet. They nearly always prefer the under surface of the leaves, probably for the sake of shelter and concealment. By July 3rd, many of the larvæ had become much paler, and the dusky dots had coalesced into longitudinal stripes. Their colour was now pale yellowish green, with yellow head and tail; and their bodies were covered with fleshy lumps or rather spines. The length was then about an inch.

Between July 14th and 25th I was away from home, and was not able to observe what occurred; but as the moults did not take place in all the larvæ at the same time, and as the larvæ differed a good deal in colour, I could not have followed the moults satisfactorily without isolating the larvæ.

On July 25th, on returning home, I found that most of the larvæ had moulted again, some for the third, and some apparently for the fourth and last time. Their colour was now uniformly green, lighter or darker according to age; and the larvæ were covered with a whitish powder, which adhered to everything they touched. Their length was now from 2½ to (when fully extended) nearly 4 inches. Some of the older ones already had the fleshy spines tipped with blue.

I now tried to remove the bags, but was obliged to replace them, as several of the smaller larvæ were at once destroyed by wasps. I may mention that I once found a spider sucking one of the very young larvæ, and that whenever I opened a bag, I always found numerous earwigs in its folds. Earwigs are said to destroy the larvæ, and doubtless they do, but I did not observe it, and do not think I lost many from this cause.

It had long before been necessary to place the larvæ fewer together, in much larger bags, and to enclose entire shoots instead of single leaves; and on July 28th I removed the greater portion of the larvæ to Glasnevin; and the remainder subsequently, as the trees I had in my garden were completely stripped. At the time I write this, however (Nov. 3rd), my trees have almost entirely recovered, and most of them look as well as if the leaves had never been eaten off. On July 28th I counted the larvæ for the first time. They now amounted to 235, so that allowing for a few casualties in their younger stages, I presume rather more that half the eggs hatched. The eggs never all hatch, and those which hatch latest nearly always produce weak and sickly silk-worms.

On the 6th of August two or three larvæ began to spin; and as the first eggs hatched June 24th, the earliest larvæ had taken no longer than six weeks to pass from the egg to the pupa state. When about to change to pupa, the larva rolls itself up in a leaflet, attaching the leaf stalk to the branch by a silk ribbon, often six inches long, so firmly that very considerable force is required to break the silk. At this period it is very important not to place more larvæ in a bag than the leaves of the shoot enclosed will supply food for, as it is most inconvenient to have to move a bag when the larvæ are spinning, as they often do so in a corner of the bag; and they ought not to be disturbed till the cocoon, which is not fully completed in less than a fortnight, has acquired tolerable consistency. I commonly contented myself with untying the mouth of the bags, and thus permitting the unchanged larvæ to wander over the trees unprotected. I often removed the bags altogether, but this does not appear to answer, for it renders the larvæ liable to the attacks of various insect parasites and birds. Birds, however, rarely attack them, and I never noticed any about the trees; but for the last few days, during which I left the larvæ unprotected, their numbers diminished in a way that I could only attribute to the intervention of birds or other animals.

About this period, too, the weather became very wet, and many larvæ died of a disease to which they are subject in wet weather, especially when reared (as mine happened to be) in the neighbourhood of a potato field. Their bodies become livid, soft, and flabby, and they fall from the trees and die. The skin is so weak in this state as to be ruptured with the slightest accident. I noticed that the larvæ were more affected on some trees than on others.

On the 19th of August all the cocoons were completed, and I finally took stock. I had 124 cocoons, nearly all decidedly healthy. Altogether, I had had about 140 cocoons; but a few which were apparently attacked by parasites I handed over to Mr. P. J. Murray for experiment; so I exclude these. Mr. Murray has kindly promised to supplement my paper with some remarks of his own on the unwinding of the cocoons, so it will not be necessary for me to anticipate him.

Another year, I do not expect to lose so large a proportion, as I shall have gained some practical experience from this year's experiment, and the trees will be better grown, and will provide more food. This year I was frequently obliged to remove the larvæ from one tree to another at most critical periods, in order to supply them with sufficient food; and the large mortality experienced during the last three weeks of the experiment is therefore not surprising.

On Sept. 28th the first moth appeared, and up to the beginning of Nov., about twenty-five have made their appearance. Nevertheless, I hope to be able to keep enough moths in cocoon through the winter to breed from next year, without the necessity of procuring a fresh supply of eggs from England. I shall try to obtain two broods next year. If the cocoons were exposed to artificial heat or cold, to accelerate or retard their development as required, it would be a great advantage in a climate so variable as that of Ireland.

I kept the moths alive, often many together, for several days. They generally appear sluggish, but fan their wings up and down constantly, when disturbed. I never found any of the moths *in coitu*, nor were any eggs laid except on two occasions, when a very few infertile ones were produced. This I believe is to be attributed solely to the coldness of the weather.

I have not time now to give any account of the experiments with the Ailanthus silk-worm in England and on the Continent. Any gentleman interested in the subject will find a full account of them in Dr. Wallace's paper on Ailanthiculture, in the "Transactions" of the Entomological Society of London, vol. v., part 2, the Prize Essay of the Society for 1865. The moth is now naturalized in New Zealand, the Cape of Good Hope, and other Colonies. In conclusion, I will only say, that there appears to be no unsurmountable obstacle to the easy naturalization of this silk-worm in Ireland; and it would be well worth rearing on a large scale, even if its silk should eventually prove only applicable for carding, which is not likely, for it is successfully wound in France, as well as in America, as I hear from a gentleman recently returned from that country, and he informs me also that the Ailanthus tree is there grown in the streets for its shade, and that the silk-worm, at first introduced as an experiment, has spread itself wild over New York and the adjacent towns, and become perfectly naturalized in that country.

Mr. P. J. Murray, an experienced silk-throwster, then produced reels of the Ailanthus worm's silk, the Japanese oak-worm's silk, and that of the ordinary mulberry silk-worm. He also exhibited specimens of tapestry showing the application of rock-spun silk. He stated that he had succeeded in reeling sixteen yards in one continuous thread from the Ailanthus cocoons, but 250 yards from that of the Japanese oak silk-worm (*B. Yama-mai*). He thought the total length of this cocoon would be 350 yards. He had no doubt that after a little practice he would be able to produce as much silk from the Ailanthus cocoons as from the ordinary Chinese cocoons. The cocoon of *B. Yama-mai* being formed like that of the ordinary silk-worm, could be reeled in the same manner; but that of *B. Cynthia*, being differently constructed, would require different treatment. He thought the deficiency of lustre in the silk of *B. Cynthia* arose from the strength of the alkaline solution required to dissolve the gum. M. Guèrin-Meneville thought the Ailanthus product would prove intermediate between silk and wool, but Mr. Murray thought it would prove equal to silk.

The Chairman (**Dr. De Ricci**) then remarked that wherever the experiment of reeling the silk of the Ailanthus worm had been tried, the thread had always been found apt to break. He thought that this silk would only be available as rock-spun silk, which is far less valuable than reeled. He stated that his experiments with *B. Yama-mai* had completely failed this year, but he thought that it would be well for gentlemen residing in different parts of the country to proceed with experiments in the rearing of both species next season. He also suggested that the peasantry should be encouraged to do so. As the oak is indigenous in Ireland, and the Ailanthus tree would have to be planted, he thought that the rearing of *B. Yama-mai* was, in every respect, preferable to that of *B. Cynthia.*

Mr. Murray stated that he had been informed by M. Guèrin-Meneville that silk-worms reared entirely in the open air yielded larger cocoons.

Mr. More observed that, as the eggs of *B. Yama-mai* are ordinarily hatched before any oak-leaves expand in the spring, it is difficult to provide them with food; but that he and Mr. Andrews had observed a tree of *Quercus sessiflora* at Killarney, which always comes into leaf a month earlier than other oak trees. [Leaves from this oak were then exhibited.] It might be desirable to establish a colony on this tree, or on another early-leaving oak of the same variety at Rosanna, Wicklow.

Dr. Moore stated that the Ailanthus was extremely easy to propagate. Stocks planted last spring at Glasnevin Botanic Gardens had grown luxuriantly, and furnished sufficient food to allow the silk worms to be fed on them during the first year. Lady Dorothy Nevill had reared the Ailanthus silk-worm, and had published a pamphlet on the subject. She had had the cocoons wound and manufactured. As great difficulty had been experienced in obtaining oak-leaves sufficiently early for *B. Yama-mai*, he was preparing to force a number of young oak-plants by placing them in pots in a greenhouse.

Mr. Kirby referred to the reports of the Paris Exhibition, in which it is stated that 800 yards have been reeled in one continuous thread from a single cocoon of *B. Cynthia*, and said that fabrics made of the silk have been found to last fifty or sixty years in

India. Lady D. Nevill deserved the credit of being the first person to introduce the insect into England, though it is now reared on the largest scale by Dr. Wallace of Colchester. Dr. Wallace always leaves a few cocoons to hang on the trees all winter, which produce very fine moths at a somewhat later date than the housed cocoons. Mr. Kirby said that a gentleman residing near London had succeeded in obtaining ten cocoons of *B. Yama-mai* from fifty worms; and a gentleman in Glasgow had obtained two from twelve. He was not aware of the result of other experiments with this species during the past season. It would not be fair to argue against the Ailanthus silk from the difficulty of reeling it, as the insect was only introduced into Europe in 1852, while the silk of the ordinary silk-worm (which is perfectly analogous to that of *B. Yama-mai*) has been the subject of experiment in Europe for the last 1000 years. Mr. Kirby could not agree with the Chairman that the oak silk-worm was likely to be more easily naturalized in Ireland, because the oak is common, and mentioned that the black-veined white butterfly, which feeds on hawthorn, is very local in England, and a doubtful native in Ireland, where hedges are universal; while on the Continent, where hedges are almost unknown, and only detached trees of hawthorn are to be met with, the butterfly abounds everywhere, and is more abundant than the white cabbage butterflies.

XXXV.—*On a New Product of the Action of Heat on the Sulphocyanate of Ammonium.* By DR. J. EMERSON REYNOLDS, Member of the Royal College of Physicians, Edinburgh, Keeper of the Minerals and Analyst to the Royal Dublin Society, &c.

(Abstract.)

[Read December 21, 1868.]

JUST as cyanate of ammonium under the influence of heat yields urea, so sulphocyanate of ammonium under similar circumstances should yield sulphur urea.

$$\left.\begin{matrix}CN\\NH_4\end{matrix}\right\}O = \left.\begin{matrix}(CO)''\\H_2\\H_2\end{matrix}\right\}N_2$$

$$\left.\begin{matrix}CN\\NH_4\end{matrix}\right\}S = \left.\begin{matrix}(CS)''\\H_2\\H_2\end{matrix}\right\}N_2$$

The probability of this reaction induced Liebig, Völckel, and some other chemists to study the action of heat upon the sulphocyanate, but the results did not agree with their expectations.

More recently Dr. Hofmann* described a number of substitution derivatives of sulphur urea, but he did not succeed in isolating the urea itself. He appears to have regarded sulphocyanate of ammonium as the true sulphur urea, in spite of its saline constitution.

On considering the points of similarity, and of difference between the cyanate and sulphocyanate of ammonium, I became convinced that the greater stability of the latter compound was the chief bar to its molecular rearrangement.

---

* "Proceedings of the Royal Society," vol. ix., p. 274.

The temperature of 100° C., which affects the conversion of the cyanate into urea, has no effect upon the sulphocyanate, which, however, decomposes easily at temperatures above 180° C. I therefore tried the effect of a regulated temperature upon the latter salt, and was rewarded by the isolation of the missing sulphur urea. I proceeded in the following manner:—

About 500 grammes of the well-dried salt were heated to 170° C., for two hours by means of an oil bath; and I remarked incidentally that the true fusing point of the salt was found to be 159° C. instead of 149°, as usually stated.

The mass was allowed to cool to 100° C., and was then treated with its own weight of water at 80° C. When the whole was dissolved, the liquid was filtered through a plug of cotton wool for the purpose of separating a small quantity of black substance, and was then allowed to stand until an abundant crop of fine long silky prisms of the new compound had formed.

After several recrystallizations from boiling water, the urea was obtained in a state of purity, and gave on analysis numbers which led to the formula—

$$\left.\begin{matrix}(CS)''\\ H_2\\ H_2\end{matrix}\right\} N_2$$

Some difficulty was experienced in the determination of the carbon, in consequence of the large proportion of nitrogen and sulphur present. It was found advantageous to introduce into the combustion tube, after filling with chromate of lead in the usual manner, a porous copper rod, prepared by rolling fine gauze so closely as to leave no central tube. This rod was heated, first in air and then in hydrogen, in the usual way, and was then made to fit closely into the combustion tube. It was found to reduce completely the nitrogen oxides formed during the combustion.

The new substance crystallizes in long fine needles, or in short thick prisms, in either case belonging to the trimetric system. It is non-deliquescent in moderately dry air, is very soluble in water and alcohol, and sparingly so in either. The solution froths slightly on agitation, has a neutral reaction, and a somewhat bitter taste. Heated with water in a sealed tube for some hours to 140° C., it is reconverted into sulphocyanate of ammonium, as may be shown by the iron test. The urea does not give a colour reaction with the test. Heated with hydrate of potassium in a sealed tube, it is decomposed in the following manner:—

$$(CS)''H_4N_2 + 2H_2O = 2NH_3 + CO_2 + H_2S.$$

Hydrochloric and sulphuric acids effect a similar change.

The substance fuses at 156° C. Heated to a higher temperature in a closed tube it evolves sulphide of ammonium, carbonic disulphide, and ammonia; the mixture blackens, a yellow oil distils over, and a white mass remains, which strongly resembles Liebig's hydromellone.

A beautifully crystallized nitrate of the new urea was prepared by treating the strong aqueous solution with nitric acid of sp. gr. 1·25. Its formula was found to be $(CS)'' H_4N_2, HNO_3$. No hydrochlorate nor oxalate could be obtained.

Gold Compound.—On treating a saturated aqueous solution of the urea with neutral terchloride of gold, a reddish precipitate appeared at first, which quickly redissolved; when a yellow colour appeared in the liquid it was slowly evaporated, and yielded pearly monoclinic crystals, to which I have assigned the singular formula—

$$\left.\begin{array}{r}(CS)'' H_4N_2 \\ (CS)'' H_4N_2 \\ Cl\end{array}\right\} Au'''$$

When the gold solution was employed in excess a very unstable compound was produced, which appeared to differ from the former one in containing only one equivalent of the urea and two of chlorine.

Platinum Compounds.—By methods analogous to the preceding, several platinum compounds were procured. For the most characteristic of them I obtained the following formula:—

$$\left.\begin{array}{r}CS''H_4N_2 \\ CS''H_4N_2 \\ Cl \\ Cl\end{array}\right\} Pt'''', HCl$$

Silver Compound.—The action of nitrate of silver on the urea yielded silky crystals having the formula—

$$[(CS)'' H_4N_2] Ag_2O + 4H_2O.$$

This compound is decomposed by heat, with slight explosion, sulphide of silver and a crystalline sublimate being formed.

When sulphur urea and oxide of silver are heated with a little water for half an hour, sulphide of silver is formed, and the sulphur urea is converted into ordinary urea—

$$(CS)'' H_4N_2 + Ag_2O = (CO)'' H_4N_2 + Ag_2S.$$

It is therefore probable that in the little-known process for the preparation of carbamide, by the action of oxide of silver on sulphocyanate of ammonium, there are really two stages, one in which sulphur urea is formed, and one in which it is converted into ordinary urea and sulphide of silver.

Mercurial Compounds.—A crystalline compound was obtained, to which I assign the formula—

$$2[(CS)'' H_4N_2], 3Hg'' O, 3H_2O.$$

But it appears probable that the compound—

$$(CS)'' H_4N_2, 4Hg''O,$$

and

$$\left.\begin{array}{r}N_2O_5 \\ (CS)''H_4N_2 \\ (CS)''H_4N_2\end{array}\right\} 8Hg''O,$$

are likewise produced in some reactions.

All ureas previously obtained possess more or less strongly marked basic properties, but I believe that the new compound is the first instance known of a urea which manifests strongly marked acid and feeble basic properties. It follows from this investigation that the new compound is the true sulpho-carbamide, the primary of the series of compound sulpho-ureas discovered by Hofmann, and that sulpho-cyanate of ammonium must be regarded as the strict analogue of cyanate of ammonium. The new urea is the primary of the following series of compounds discovered from time to time by Dr. Hofmann, in the course of his fine researches on the polyammonias:—

Sulphocarbamide, ... $\left.\begin{matrix}(CS)''\\ H_2\\ H_2\end{matrix}\right\} N_2.$

Phenyl-sulphocarbamide, ... $\left.\begin{matrix}(CS)''\\ C_6H_5\\ H_3\end{matrix}\right\} N_2.$

Phenyl-allyl-sulphocarbamide, . . $\left.\begin{matrix}(CS)''\\ C_6H_5\\ C_3H_5\\ H^2\end{matrix}\right\} N_2.$

and of the complex products of the action of triethylphosphine on sulphocyanates of phenyl and of allyl.

I may now conclude by predicting the formation of sulphur-urea by the action of heat on sulphocarbamate of ammonium. Such a reaction would be perfectly parallel with that by which Bassaroff produced urea, namely, by the dehydration of carbamate of ammonium. The following equation expresses the decomposition which I would expect to ensue when sulphocarbamate of ammonium would break up under the influence of heat:—

$$\left.\begin{matrix}CS)''H_2N\\ H_4N\end{matrix}\right\} S = \left.\begin{matrix}(CS)''\\ H_2\\ H_2\end{matrix}\right\} N_2 + H_2S.$$

XXXVI.—*Notes on some Experiments made to grow Kohl-Rabi among Mangold-Wurtzel at the Botanic Garden.* By D. MOORE, PH. D., Director of the Botanic Garden of the Royal Dublin Society.

[Read January 18, 1869.]

WHEN reading my Annual Report on the Botanic Garden before the Committee of Botany last Monday, I stated, among other matters, that the experiment of growing a crop of kohl-rabi among one of mangold-wurtzel had been again tried with success. Some of the members present suggested that it might be of some public utility if I would read a short paper on the subject at one of the Society's evening meetings, and embody in it the results I had then mentioned, as well as those stated in former Reports, which the chairman, S. Foot, Esq., requested me to do; hence the reason of this communication.

In order to render the matter intelligible, I shall first briefly reiterate the statements made in former Reports, and secondly, the manner of making the experiment.

In January, 1866, when reporting on what had been done in the experimental department of the Garden during the year 1865 (see "Proceedings of Royal Dublin Society," vol. 102, Appendix I.) I stated that Laurence Waldron, Esq., D. L., had presented some seed of kohl-rabi, requesting at same time that an experiment might be made with it, to grow, as what agriculturists sometimes term a stolen crop, among a crop of mangold-wurtzel. When handing to me the seed, Mr. Waldron accompanied it with a note containing instructions how he wished the experiment to be conducted. This I put into the hands of the foreman who had the management of the department, and desired him to carry it out in every particular, according to the instructions contained therein, which he did, and succeeded, with this exception, that, according to Mr. Waldron's plan, the crop of kohl-rabi should be fully grown and ready to be fed off before the mangold leaves close too much over them; whereas, we found that at the end of July they were not enough grown, when we had them taken up and planted on ground which had just been cleared of early potatoes, where they ripened their bulbous stems, and became a good crop. When reporting on the year 1866 in January, 1867, I stated that the experiment had again been tried successfully in a similar way to that of 1865—"Proceedings of Royal Dublin Society," vol. 103, Appendix II., p. 14. For 1867 ("Proceedings of Royal Dublin Society, vol. 104, Appendix II., page 6), I had again occasion to mention that this experiment had been repeated at the request of Mr. Waldron with more success than during the two previous years, inasmuch as the crop of kohl-rabi had been fully ripened in good time to be fed off before the leaves of the mangold closed over them, thus doing away with the necessity of replanting, and, of course, lessening the cost considerably. The crop was a good one, and contained many very fine examples of that peculiar vegetable. In August of that year the Royal Agricultural Society held their exhibition in Stephen's-green, where I desired the foreman to send some good samples of the crop, and a written statement how they had been grown, in order to enable those who felt interested in the matter to see them. Being obliged to leave Dublin at that time for England, the man mistook my directions, and sent them to the Royal Horticultural Society's Exhibition at Salt-hill, but afterwards to the Agricultural Society also, so that they were exhibited at both shows, and ample opportunities afforded for seeing those samples.

Last year we experimented further, and proved that it is not even necessary to remove the kohl-rabi early in the year, but by judicious management both crops may remain together until the time of taking up and housing arrives, without being injurious to each other. It is managed as follows:—About the beginning of September, when grass is getting scarce, the leaves of the mangold begin to close over the kohl-rabi, which may then be carefully thinned for cattle, so as to let in sufficient air and light, without denuding the mangold too much, so as to injure their growth, or even lessen their produce. By managing so, both crops were of fair average quality at the end of October last year, when they were taken up. I have thus been careful to note the results of those experiments, and when they were made, in order that the different Reports may be further examined by those who feel inclined to do so. I need only add that Mr. Waldron has lately sent some fresh seed of kohl-rabi he brought from Germany, which I hope to have treated in a similar manner as the crop of the past year was treated. If successful, they shall be weighed, and the results per perch or acre given, that being the wanting link to an agriculturist in these experiments.

I shall now detail how the experiment may be made in accordance with Mr. Waldron's plan.

About the beginning of February the seed of the kohl-rabi is sown on a slight hotbed, where the plants vegetate freely, and must be carefully inured to the open air by removing the sash from the frame gradually, or the covering from off the bed, if there be no glazed frame, which latter is not absolutely necessary. After the plants get sufficient strength, and have become sufficiently hardened to bear transplanting, they should be pricked out on a rich piece of ground or nursing-bed, where they stand until the first week in May, when the mangold ought to be sown. The furrows between the drills are then well forked up, and a small quantity of guano or bone-dust manure put on them before the kohl-rabi is planted, which will now be strong, and grow with great vigour, if the season prove favourable. Nothing farther is necessary, but to keep them free from weeds and vermin, rabbits being very fond of the kohl-rabi at this early period of the year. Judging from past experience, I believe that much of success depends on having the plants early and well hardened, so that they can be lifted from the nursing-bed, with good roots, and not receive too great a check in transplanting, particularly if the weather prove dry when that operation is performed.

XXXVII.—*On the Estimation of Soluble and Insoluble Phosphates in Superphosphate of Lime and other Phosphatic Manures.* By J. EMERSON REYNOLDS, Member of the Royal College of Physicians, Edinburgh; Keeper of the Minerals and Analyst to the Royal Dublin Society.

[Read February 15, 1869.]

ON a former occasion I had the honour of laying before the Society an account of an extended series of analyses which I conducted in the chemical laboratory of this institution, on a rapid and accurate mode of estimating phosphoric acid in superphosphate of lime and other similar substances, by an improved gravimetric process. The method of analysis reported upon was that known as Chancel's process, and consists in converting the phosphoric acid present in a solution into the phosphate of bismuth, a very insoluble compound which can be easily washed, ignited and weighed.

In the paper referred to I pointed out the precautions which have to be taken in order to ensure accuracy when using this bismuth process, and also stated, as the result of my experience, that estimations of phosphoric acid could be effected in less time by this than by any other gravimetric method of analysis at present in use. I have already stated that the experiments previously undertaken were made for the purpose of determining the most favourable conditions for the employment of nitrate of bismuth solution as a precipitant for phosphoric acid, the phosphate of bismuth produced in the analysis being weighed as such, and the proportion of phosphoric acid present calculated from the weight obtained. In M. Chancel's paper he suggests the probability of using the nitrate of bismuth solution in effecting the estimation of phosphoric acid by the method of volumetric analysis. My earlier experiments in this direction led to the conclusion that the bismuth solution was unsuitable for the purpose indicated; but more extended investigation has enabled me to fix the conditions under which accurate results can be obtained, and I have now the pleasure of laying before you the details of a volumetric method of estimating phosphoric acid, which has afforded me the most satisfactory results.

I will not detain you now by considering the various modes at present in use for the estimation of phosphoric acid by *gravimetric* methods of analysis; suffice it to say that we have several excellent processes at our disposal, but all of these are tedious in operation. It is now only to the *volumetric* modes of estimation that I would ask your attention. The best known processes are those of Schwartz, Mohr, Raewsky, Liebig, and Pincus. In conducting the lead process of Schwartz and Mohr, it is exceedingly difficult to ascertain the exact point at which all the phosphoric acid has been precipitated by the standard lead solution employed for the purpose; again, the uncertainty of the composition of the compounds produced in the iron processes of Raewsky and Liebig precludes the adoption of these methods in accurate analysis; and finally, the presence of much alumina and iron in a solution so seriously interferes with the accuracy of the results obtained by the uranium process of Pincus as to considerably diminish the practical value of this otherwise useful method of analysis. Though I have thus summarily disposed of the several volumetric processes at present known, I do not wish in any way to detract from the value of their indications in careful hands, and under special conditions; but it will be evident, from what has been stated, that a good volumetric process for estimating one of the most important constituents of our artificial manures is at present a desideratum, and I hope now to be able to show you that the plan which I have now to describe supplies this want to a great extent, and that it is capable of yielding, in careful hands, results of as high a degree of accuracy as any other volumetric process; in addition to which it possesses the important advantage of being more generally applicable than the methods already alluded to.

For convenience of description, I may refer to the main points of the bismuth process, under three heads, viz.:—1. Preparation of the bismuth solution. 2. Standardizing the liquid. 3. The process of analysis.

1. *Preparation of the Bismuth Solution.*—This is easily accomplished, by dissolving 60 grammes of pure sub-nitrate of bismuth in 260 cubic centimetres of nitric acid of sp. gr. 1·35, and when complete solution has been effected by the aid of heat, the liquid is diluted with about 1·800 c. c. of distilled water. The liquid should yield no precipitate on boiling or on diluting with six times its volume of water.

2. *Standardising the Bismuth Solution.*—Having prepared a test solution as above described, we have now to ascertain its strength accurately; and here an interesting and elegant mode of solving the problem may be adopted; for we can make two solutions of unknown strength—one of bismuth, and the other containing phosphoric acid; measure each other, and yield an absolute, not merely a relative, value for the phosphoric acid corresponding to an ascertained volume, and this without the use of any further reagent. In order to illustrate my meaning, I cannot do better than give the details of an actual experiment.

Ten cubic centimetres of a solution of phosphate of sodium, of unknown strength, were placed in a flask, 80 c. c. of water and a few drops of nitric acid added, and the solution boiled. To the hot liquid a solution of bismuth, also of unknown strength, was cautiously added, until no further precipitate of phosphate of bismuth made its appearance. 18·5 c. c. of the bismuth solution were required for this complete precipitation. The dense white precipitate of phosphate of bismuth was now caught on a filter in the usual way, washed, dried, ignited, and found to weigh ·797 gramme. We have now all the data required for calculating the strength of our solution. In the first place, we find that when the amount of bismuth precipitate obtained is multiplied by the factor for the phosphoric anhydride which it contains, we get the quantity of the latter present in the 10 c. c. of phosphate of sodium solution, and to which 18·5 c. c. of the bismuth test correspond, thus—

$$\cdot797 \times \cdot2328 = \cdot1855416 \text{ grm. } P_2O_5.$$

For convenience sake, we then want to know how much phosphoric anhydride 100 c. c. of our bismuth solution is capable of precipitating, and this quantity we find simply by the following calculation:—

$$\frac{100 \times \cdot1855416}{18\cdot5} = 1\cdot0028 \text{ grm. } P_2O_5.$$

100c. c. of our bismuth solution will then precipitate completely 1.0028 grammes of the anhydride; but it is more convenient to have a solution 100 c. c. of which correspond exactly to one gramme of phosphoric anhydride. By a final calculation, we ascertain how this may be accomplished; thus—

$$\frac{100}{1\cdot0028} = 99\cdot72 \text{ c. c.}$$

We have therefore to dilute every 997·2 c. c. of our bismuth solution to the bulk of one litre, and we then obtain a solution every cubic centimetre of which corresponds to ·01 grm. of phosphoric anhydride.

3. *The Analytical Process.*—In this, as in any other method of analysis, it would be impossible to give rules of universal application as to the manner in which the plan should be employed. This must always be left to the judgment of the chemist, as different cases require variations in treatment. I will therefore give here only the general precautions which have to be taken in employing this method. It is to be observed that the bismuth test must only be added to the phosphate solution when the latter is raised to the boiling temperature. The test must be slowly added by allowing it to run down the side of the flask, and a rotatory motion then given to the vessel after each addition. If these directions be strictly attended to, there is no difficulty in hitting the exact point at which all the phosphoric acid has been precipitated. It may seem strange to say so, but attention to this apparently trifling manipulative point makes the difference between success and failure in affecting an analysis by the method which I have described. This process may be used in the presence of considerable quantities of alumina, or of almost all other bases which usually occur in manures; but ammonia must be removed either by ignition or by boiling with excess of caustic potash. In the latter case the liquid is treated with an excess of nitric acid, prior to running in the bismuth test. Again, persalts of iron must be reduced to the state of protosalts, and sulphuric and hydrochloric acids, if present, removed by treatment with excess of nitrate of barium and of silver.

I have now to conclude this communication by expressing the hope that the results of this inquiry may prove useful to those chemists who, like myself, wish to obtain results of a high degree of accuracy with as small an expenditure of time as possible.

XXXVIII.—*On the Ichthyology of the South-west Coast of Ireland, and a Collection of Zoological Specimens obtained for the Society during the Summer and Autumn of* 1868. By WILLIAM ANDREWS, M. R. I. A., Chairman of the Committee of Natural History, Royal Dublin Society.

[Read February 1, 1869.]

As Mr. A. G. More, Assistant in the Museum Department under the Director, Dr. Carte, has handed to me the details of what were obtained during the time that he was with me in the neighbourhood of Dingle, coast of Kerry, in the month of August last, I thought it might be of interest to exhibit to the members a portion of the collection I had subsequently made to those enumerated by Mr. More, especially as the Museum, under the superintendence of the Board of Public Works, was undergoing painting and refitting, which prevented the present arrangement of the specimens.

The objects of this Society are principally to extend in every way a knowledge of the several branches of science for the promotion of the industry and resources immediately in connexion with this country, and therefore it was considered desirable to obtain all information, more particularly with reference to the marine zoology of our coasts, and to collect such specimens, of which the Museum was very deficient.

With this view, as Chairman of the Natural History Department, I undertook to investigate a portion of the south-west coast. During the time that Mr. More could, from other engagements, devote to those pursuits, he gave great assistance; but finding that much was to be accomplished, I later in the season again visited that part of the coast, though ill prepared with materials to carry out effectively investigations so as to ensure more complete success. I have often before alluded to the extreme difficulty of arriving at accurate views through examinations of closet manipulation—how doubtful it is to depend upon the information of the mere collector, or upon the non-scientific, though practical man; or more decidedy erroneous to rest upon the vague ideas that mere science may, in its speculative analogies, create among varied forms and features, which have caused confusion in the nomenclature of specific affinities.

The scenes of operations were the Bay of Dingle, the Blasket Islands, and the harbours in the immediate neighbourhood. Provided with an efficient boat, dredges, and trawl-net, the examination of a harbour is of easy accomplishment; but when the weather is adverse in such a wild bay as that of Dingle, and amid the strong currents around the islands, the working of a heavy dredge or trawl is a labour of extreme toil and tediousness. With an able boat of 55 tons, and a most efficient crew, I made many attempts to work to the westward of the islands; but during the month of October that I spent there, continued gales of wind prevailed, varying from S.S.W. to N.N.W., and it may readily be imagined the heavy sea sent in from the Atlantic Ocean, on a part of the coast so completely exposed to western gales.

Eastward of the islands, and at the entrance of the bay, the soundings vary from 40 to 59 fathoms. Westerly of the great Foze Rock the 80-fathom line is about 30 miles; 38 miles we reach the 100 fathom line, and 400 fathoms about 95 miles. In steady winds off the land I have dredged in 80 fathoms; but to attempt with the heavy swell and strong currents that continuously occurred during my stay at Dingle would entail an amount of labour and necessary length of dredge warp, that even the craft that I was in, and with able men and winches, could not, with safety to the gear, meet the strain.

The effects of currents of the ocean is clearly explained by Maury in the "Physical Geography of the Sea," for he observes—"There is in the ocean, as in the air, a system of currents and counter-currents, one above the other, which operated upon the bight of the line, and caused it to continue to run out after the shot had reachedthe bottom." In deep water dredging it is extremely difficult to know accurately the fathoms of soundings, for, owing to the curve of the line, an immense scope of dredge-rope must be paid out before the dredge can with certainty be found to work on the bottom. I give two instances of the state of the weather:—Wednesday, 14th October—Hove-to off the Western Island. Eight A. M., barometer suddenly rising; wind, N.N.E., with squally sky to windward. Eleven A. M. wind veered, with flaws and sharp puffs; at noon shifted to W.N.W., thick, with rain, and blowing fresh; ran for Dingle at 4 P. M.; heavy gale. Tuesday, 27th October—Night beautifully clear, and moon bright; wind moderate at N.N.W.; barometer steadily rose to 30·50; all prepared for a run to sea next morning. 28th October, 8 A. M.—Dull and cloudy; wind, W.S.W.; barometer gradually falling; at noon wind increased to a heavy gale, with rain. Her Majesty's gunboat "Cromer," commanded by Lieutenant Heron, came into Dingle, having shipped heavy seas, and unable to visit several of the coastguard stations to deliver the new Schneider rifles she had on board.

To carry out usefully the investigations of a coast, it is essentially necessary to have instruments to determine accurately soundings and bearings, and so far I had a good compass, lead-line, the latest Admiralty charts, especially one published in August, 1867, of the North Atlantic Ocean, under the superintendence of Captain Richards, F. R. S., and an admirable aneroid barometer which was supplied to me by Mr. Yates of Grafton-street, was of the most important value. I cannot too strongly represent the value of this instrument as a "weather glass;" with its improved principles of compensation, its accuracy was unfailing. The late Admiral Fitzroy mentioned, "that he had one in constant use for ten years, and it was as good at the end of that time as at first, and that now and then, compared with a good barometer, it may be relied on thoroughly."

Before enumerating the several specimens exhibited, I may mention that, with few exceptions, the entire were obtained by me in the living state, and that at the time of capture the depth and character of soundings, with any peculiarity of habit and range, were noted. Those that were taken on long lines, being generally dead, had lost much of their beauty of colour and appearance, and could not be preserved in the manner which characterizes those captured by trawl or dredge in the living state. So different an appearance and colour do most kinds of fish that are brilliantly marked present almost immediately after death, that unless obtained in the living state on the grounds they frequent, and noted at the time by those conversant with the science of the subject, no accurate views can be maintained. Hence, much confusion has arisen from the descriptive accounts of fishermen, who are never sufficiently interested in, or disposed to be attentive to, truthful representations. There are several kinds of rare fish that are only met with and taken in deep water soundings on the long lines, and these generally dying before the lines are hauled, and sometimes mutilated by other fish, have lost most of their beauty of colour and of form. All kinds whose colours or markings are of intensity in the living state, of scarlet, crimson, or blue, lose immediately after death much of their bright colours, which change to a dull gray or leaden hue. Striking examples, as seen in several species of *Trigla*, especially *T. lucerna* and Bloch's gurnard, and the beautiful *Cottus grœnlandicus* lose their crimson and violet shades. To preserve much of the brightness of the colour and form, it is necessary in the living state to wash the specimens thoroughly from slime, either in sea water or fresh water, the fish being either marine or fresh water, and then to plunge them into the jar or bottle of preservative spirit. The fish are instantaneously killed, expanding rigidly all their fins, and the colours in most instances become permanently fixed. This is seen in the beautiful examples of *Cottus*, in several of the *Labridæ* or wrasses, in the *Sepiadæ*, and in a species of Goby, *Paganellus*, which is rare to the ichthyology of Ireland, and which I obtained some years since in Sneem Harbour, Kenmare Bay. This was preserved in spirit by Dr. Carte, and has undergone but little change, except the beautiful crimson marking of the dorsal fin.

To Dr. Carte is due the suggestion of preserving the more delicate animals of marine invertebrata in the perfectly expanded state as in life, and the retaining of their beautiful colours. It is simply when the living specimen is procured to place it carefully in a vase of sea water, and allowing rest till the animal expands, when, introducing gradually, through a fine glass tube, strong spirits of wine, the animal is killed, and remains in a non-retractile state. Thus, I have succeeded with *Serpula*, *Tubularia*, *Laomedea*, *Cyathina Smithii*, and a beautiful and vividly coloured animal, *Balanophyllia*. The characters of the two latter I have noticed. *Cyathina*, I may mention, has been taken up in fifteen fathoms in Dingle Bay, and that it is not, as has been stated, confined to low-water tide marks. The continued tempestuousness of the weather prevented my successfully obtaining *Millepora cervicornis* with the living animals.

Before giving any details of the series of specimens exhibited, it is right to say that the extreme beauty they display in the preparation is due to Mr. Robert Pride, the Taxidermidst of the Society, whose anxious attention at all times, and his good taste and judgment in the execution of his duties, are deserving of the highest commendation.

In enumerating the several specimens, the greater part marine, I shall refer to those that have actually been obtained, and, with the understanding that it is not my intention to enter into any characteristics of species further than is necessary to record locality, reserving any descriptive facts for hereafter communications. Taking, then, the fishes in the order arranged in works on British ichthyology, the first is the smallest and yet one of the greatest interest—the lanceolet, *Amphioxus lanceolatus*. This was taken off the Wild Bank, Dingle Bay, in 29 fathoms—coarse yellow sand. Some beautiful specimens of *Hippolyte* were taken with it, and *Sepiola Rondeletii*, showing the delicate animals that exist in deep water soundings. Westward of the Tiraght Rock, very minute *Crustaceæ*, and both *Palæmon serratus* and *Pandalus annulicornis* were taken in 80 fathoms. The sand eel, and sand launce, *Ammodytes tobianus* and *A. lancea* were numerous in Dingle Harbour and the Short Strand: the former, more rare and local, were particularly fine specimens. Small fry of the herring and the pilchard are met with in the month of October in great quantities in Dingle and in Ventry Harbours and the Short Strand. These are the young of the summer fish which shoal in the bay to spawn. Pilchards are sometimes abundantly taken in the month of August from the mouth of Dingle Harbour to the Crow Rock. In Sneem Harbour, Kenmare Bay, I have observed herrings in immense numbers coming into shoal water to spawn. Very fine and large specimens of the gar fish—*Belone esox*—are captured with the seine when they come into Dingle Harbour to spawn in the month of July. In September and in October the young state may be taken in abundance, the minute fry being identical with *Hemiramphus*, which it has been erroneously considered. In the very young state the upper mandible is scarcely produced, but, as age increases, the mandible extends until at maturity it nearly equals in length the lower mandible. The saury pike, or skipper—*Scomberesox Camperi*—is considered rare. The specimen that I obtained was taken on a hand-line when fishing for bream westward of the Crow Rock. On fine nights they not unfrequently leap into the canoes. The flying fish—*Exocœtus*—were seen in numbers in the early part of last summer in Dingle Bay. I was not able to obtain a specimen, but merely the pectoral fins. It would appear to be the species Volitans, as from description they were similar to those seen off Plymouth. A family numerous in their varieties, the *Cyclolabridæ*, have been taken in Dingle Harbour. Such variations in the markings, and such brilliant colours are seen in this family, that several species have been made. Those obtained are the ***Labrus maculatus***, L. ***lineatus***, L. ***mixtus***, L. ***trimaculatus***, L. ***cornubicus***, L. ***comber***, ***crenilabrus melops***, and ***C. minor***. Several others present such varied markings, that until the opportunity is afforded of reference to the valuable work of Fries och Ekström, some points must remain undetermined. The poor, or power cod, ***Morrhua minuta***, taken in deep water off Valentia. It is observed that wherever this little fish is met, the grounds are good for cod-fishing, and the same is remarked of the Norway haddock, ***Sebastes norvegicus***. Conch's whiting, ***Merlangus albus***, has been taken both in Dingle and Galway Bays, but the specimens were too large to preserve. ***Motella quinquecirrata*** and the mackerel midge, ***Motella glauca***, were taken in seven fathoms in Ventry Harbour. Fine specimens of the tadpole hake, ***Raniceps fuscus***, were taken on spilliards in deep water in Dingle Bay, and a fine specimen, presented by Sir Dominic Corrigan, was taken in Dalkey Sound. This fish is rare and local. Of the ***Pleuronectidæ***, several have been added to the collection—***Platessa microcephalus***, ***Solea nasuta***, ***S. lingula***, ***S. variegata***, ***Psetta arnoglossa***, ***Zeugopterus hirtus***. Of the gurnards, several rare species have been taken, but there are some remarkable features in the changes that they exhibit which I shall reserve for future remarks. The bullheads, as they are termed—***Cottus bubalis***, ***C. Scorpius***, and ***C. grœnlandicus***—are remarkable for their extreme beauty of markings and colours: the latter, captured in Dingle Harbour, was the first European specimen obtained. Of the same order is the Bergylt, ***Sebastes norvegicus***, first recorded as Irish, taken in deep water off the Foze Rock, coast of Kerry. Stone basse, or wreck fish—***Polyprion cernium***—was first recorded from Dingle Bay a few years since, captured in a floating meal barrel; the second was taken in August last, on spilliards in the same locality; these are the only recorded Irish specimens of those fish. Very fine specimens of the Atherine or sand smelt—***Atherinus presbyter***—are taken in the winter months on the sandy grounds eastward of Dingle Harbour. In the summer months they come into the harbour in immense numbers to spawn, and I have obtained them in the fry state, and also those of the mullet—***Mugil chelo***—which spawn at the same time. The boar fish—***Capros aper***—was taken in the trawl-net in deep water off Ventry Harbour, the first recorded Irish specimen. ***Gobius niger***, I did not myself meet in Dingle Harbour, but fine specimens, with ***G. paganellus***, were obtained in Sneem Harbour, Kenmare Bay. Beautiful specimens of ***Lepidogaster cornubiensis*** were taken in a rock pool, low water mark, Western Blasket Island. ***Blennius montagui***, new to Irish ichthyology, was taken both in the mature and young state, and varieties of the shanny. Of the ***Syngnathidæ***, or pipe fish family, all the known British species have been taken. The deep-nosed pipe fish, true marsupials, with caudal fins, were particularly beautiful. The two kinds that are described as occurring on the Swedish coasts, both in the Baltic and also in the Cattegat, were both found—one green, with yellow spots, the belly a brass yellow; the other olive brown, sprinkled with white spots and markings, the belly whitish. They were obtained with the ova as well as the young fry in the pouch of the male. The Porbeagle, or Beaumaris Shark, was captured in Dingle Bay, and sent to the Society; and a fine specimen of *Torpedo nobiliana*, too large to preserve. I have passed over many that have either been captured or noticed, but were too troublesome to preserve. Most that I have detailed are in the Society's collections, and a number of duplicates useful for exchange.

It must have been seen how strikingly the S. W. coast of this country, in its marine fauna, bears upon that of the coasts of Devon and of Cornwall, and that several species are peculiar to the Mediterranean, thus characterizing a Lusitanian fauna, while there are representatives of a Northern or Scandinavian. In the former we have *Amphioxus*, *Ammodytes tobianus*, *Merlangus albus*, *Psetta arnoglossa*, *Mullus surmuletus*, *Polyprion cernium*, *Pagellus*, *erythrinus*, *Cantharus griseus*, *Scomber colias*, *Scomber thynnus*, *Centrolophus pompilus*, *Capros aper*, *Lepidogaster cornubiensis*, *Blennius montagui*, and *Balistes capriscus*, all captured in Dingle and Brandon Bays, and immediate harbours. Of the Northern, many of the *Cyclolabridæ*, *Morrhua minuta*, *Brosmius vulgaris*, *Cottus grœnlandicus*, *Sebastes norvegicus*, *Syngnathus typhle*, and several others. Other marine productions I shall not at present detail, further than to remark, that beautiful specimens of the Crustacea were obtained, particularly of the *Portunidæ*, *P. marmoreus*, *corrugatus*, *holsatus*, *and depurator*. *Portunus corrugatus* was much more local; and on examination of this beautiful species, which has a very wrinkled and elevated ridgy state of the carapace, and its colour rich dark sienna or umber, is widely different from those wrinkled varieties of *P. depurator* that have been confounded with it. Of the Mollusca, some very fine and beautiful specimens of *Eledone cirhosus*, were taken. This interesting cuttle fish presents great varieties both in form and colour. Its rich tints, generally of a plum colour, tinged with brown, change to reddish brown, violet, and pale buff. Also were obtained *Sepiola rondeletii* and *S. Atlantica;* the former, extremely rare, taken in 28 fathoms in the bay, the latter in Dingle Harbour. Of the Spongiadæ, several interesting forms were taken, especially of Cliona and Pachymatisma: the latter difficult to obtain, with regard to which and others I shall reserve for future remarks.

The Director of the Museum, Dr. Carte, very properly suggested the desire to obtain from the different rivers and lakes of Ireland all the varied forms of the Salmonidæ. These would characterize seasons, water supply, deposits, and feeding grounds of our numerous lakes and rivers. In many lakes the feeding grounds vary so much, that the parts where muddy deposit and sedgy growth exist, the trout are ugly formed, dark coloured, with goggle eyes, and which are called "Duileacan;" other parts, where clear, shingly or sandy gravel forms the bed, the trout are beautifully formed, bright and well-fed. There are peculiar varieties in those beautiful lakes in Kerry, Deriana, Cloonloughlin, and Locnamona, and where there are splendid specimens of the brown trout. In Locnamona is a beautiful and well-fed trout, termed by the fishermen, greenbacks. Their backs are an olivaceous green, with silvery bellies. I have made from time to time, and at different seasons, an extensive collection of the Salmonidæ, and in their spawning states and stages of growth. All such investigations are of material importance with regard to our inland fisheries, being the guide by which protection and increase can be judiciously regulated. The same view bears strongly on our sea fisheries. All ova-bearing fish are compelled by instinct to leave their deep water haunts, and to move to shoaler grounds to deposit their spawn. Viviparous fish, as the dogfish, chiefly produce their young on the grounds of the deep water they frequent.

I have seen *Galeus canis*, *G. acanthias*, and *Squalus mustelus*, taken in 50 and 80 fathoms in the month of July, to exclude on the deck of the vessel the young with the vitelline sac attached. The *Salmo ferox*, and the *Char*, which keep to the deep water of lakes, do not visit the shoaler water or the rivers until the approaching time to spawn. Again, the salmon, the white trout, and the bull trout, leave their feeding grounds of the coast, as well as the shad, *Alosa finta* and *A. communis*, to resort to the shallows of rivers or lakes to deposit their ova. Hence, the shad, belonging to the herring family, are frequently taken in numbers in the salmon nets in the Lakes of Killarney, termed there by the fishermen as *goureens*, and which led an official of the fisheries to report with astonished delight that herrings could be taken in the Lakes of Killarney.

The chief objects of this subject are not so much the mere obtaining of the specimens for the Museum, but the information derived from such investigations, where the true habits of our sea fish can be made known, their localities, seasons, and the depths and soundings they resort, which may thus give useful light and instruction for the advancement of our fisheries.

Before concluding, I may make some allusion to the state of our sea fisheries. For the last quarter of a century repeated Acts of Parliament have been framed for amendment thereto, and each Session the old story is repeated without amendment. Huge projects of advancement have been contemplated, and the Government hustled with wondrous schemes of Rockall fishing-grounds and Bottle-nose Whale captures, yet still we are in the same dormant state. Seriously, though, the evils are growing worse in the depopulated state of our coasts from the absence of all encouragement to our fishermen. The sea coasts of Ireland present the very opposite features to those of England —the almost total absence of coast proprietary, no trade community, no flourishing towns or villages where manufactures or profitable industry are carried on—therefore little countenance or aid can be afforded to the hardy fishermen of those shores. Again, the want of harbour improvement, and suitable piers for the protection of better-class boats, and this want is much felt on our eastern coasts; while, on the other hand, the English shores have overlooking and encouraging landowners, and flourishing trading towns, which impart spirit to the fishermen, and aid towards the expensive outfits of suitable crafts. Thus, it is stated, in the Report of the Commissioners of Irish Fisheries for 1852, how flourishing were the fishing towns of the south coast of England. At Brixham the fishermen were prosperous and comfortable, possessing a large number of fine boats, a convenient club-house, and every encouragement for their comfort, and adds that most of the boats belong to wealthy owners on shares. The crews and masters have shares in the vessel. The vessel's share keeps up its equipment, and provisions are found by the owners. How could the crews of the fine trawl boats of Ringsend and Kingstown fit them out were they not assisted by spirited and moneyed owners? I give an extract from a treatise published in Dublin in the year 1820—" A View of the British and Irish Fisheries,"—by an old sailor and naval officer. At page 26—" When we consider the description of boats the Irish are accustomed to, and the manner in which they are fitted out—the diminutive size of those on the northern and western coasts as compared with the seas they contend with—they amply prove that the qualities of courage and intrepidity, and even skill as boatmen, are not wanting to prevent the Irish from succeeding in any undertaking of this kind. Thus, without even hinting at any disparagement of the English with respect to their known intrepidity, it may be remarked that they enjoy more constant security in well-finished and well-found vessels, and more extensive comforts in every way than we possess; and, even possessing those advantages, we fear not contradiction in asserting that the fishing-boats of Galway and other parts of Ireland constantly put to sea and procure their fish for a miserable market in gales of wind when those of Torbay lie snug at Brixham quay."

In my experience of Galway Bay, the Shannon, and Dingle Bay, I can bear testimony to numerous instances of intrepidity and hardihood of the fishermen of those coasts. As Galway has been alluded to in the foregoing extract, I may make some comments upon the past and present state of its fishing population. In 1822 it had a large body of fishermen, most of them provided with first-class hookers, with which boats they were most successful and daring, venturing in very rough weather to the fishing grounds of the bay, and to the island of Innisbofin, on the coast of Mayo, during the sun-fish season. At that time the men of the Claddagh numbered nearly 1,200. A plan of the Claddagh, made by Mr. Nimmo, engineer to the Commissioners of Fisheries, shows the houses of the fishermen to have formed an extensive range along the shore of the River Corrib, and the Mayor of the Claddagh occupied a suitable residence. The sad years of cholera and famine, from which the Claddagh and the fishermen of the Arran Isles never recovered, almost depopulated the villages of the coast. In 1853, through the munificence of Major French, the Claddagh men again were stimulated to exertion in their pursuits, and the following address proves the gratefulness of their feelings, and their desire to enter into improved systems of fishing. The address is beautifully printed on satin :

"TO MAJOR FRENCH.

"The members of the Committee for the relief of the Claddagh fishermen beg to hail your return to your native city, and respectfully to tender you their grateful acknowledgments for the succour you have afforded to the suffering Claddagh fishermen. The munificent contribution you have bestowed to aid and encourage them to make an experiment in trawling has stimulated the almost despairing fishermen to the most successful efforts, and extended their labours in the exercise of a most profitable employment. The committee avail themselves of your presence in the land of your fathers, after a lengthened absence in India, where you also sympathized in the sufferings of Ireland, to express their deep and lasting obligations for the seasonable and substantial aid you have bestowed on the Claddagh fishermen, restoring and establishing their reduced and impoverished families, by awakening the most lively and active exertion of this long-neglected colony. The fishermen will recognise you in future as their most liberal benefactor, who has taken an enlarged and enlightened view of the many and varied circumstances that had hitherto contributed to their depression, and will date from your advent to your native country the dawn of their prosperity and more happy times, while they assure you they will retain a lively and lasting sense of your liberality and munificence.

"B. J. Roche, P. P., V.G., *Chairman.*

"*Committee Rooms, Galway,*
"*October* 24, 1853."

The success which followed this assistance is shown by the extracts from the Reports of the Commissioners of Fisheries for 1854, at page 5. —"At present they (the fisheries at Galway) are improving very greatly since the Claddagh men have begun to trawl. The produce greatly increased, owing to the average of twenty trawlers being employed in the bay instead of one." "Instances of conflicts much less frequent, and the habits of the fishermen more orderly and peaceable since the Claddagh men have been induced to trawl themselves." "This state of things has tended more to extinguish the old established prejudices of this primitive community than either argument or physical force." What is now the case with the poor Claddagh man? Misery and destitution surround him. Mr. Henry Scott, of Galway, whom I have long esteemed and known as a man of veracity and of practical experience in the fisheries, writes to me in December last:—"They have about fifty or fifty-five small boats of from three to six tons; very few of the six-ton class, not more than six or eight, and in most instances very badly found in sails and rigging; in fact, their nets and gear of every kind are in the pawn-office. There are only three of the large class of nine or ten tons burthen in the Claddagh now. I remember (writes Mr. Scott) when there were sixty or seventy of that class, all well found. They took great pride in keeping them in first-rate order and sailing trim. From all I can learn, there are not quite 200 men in the Claddagh just now—that is of the old stock, as they call themselves. Most of them have emigrated, and young and able hands have joined the navy or merchant service." He continues—"I have seen within these few days men of the Claddagh, that some years since were known to be, and always to have been, with their families, in comfortable circumstances, now reduced to the extremes of poverty." On other parts of the coast we can paint the same scenes, and even our able seamen of Skerries and of Rush are feeling neglect, and the want of proper harbour accommodation and protection for boats of a tonnage which would be serviceable in all weathers. Our class of fine trawl boats, which form our best seamen, are subjected to restrictions to a needless extent around the coasts of Ireland, while those laws have never been practised on the coast of England. We are to assume that the Convention and Sea Fisheries Bill, which passed the last Session of Parliament, will be beneficially productive; but the tendencies are more likely to result in crippling the energies of our fishermen by the free admission to our ports of the fishermen of France, and probably the same indulgence may be sought with regard to other maritime powers. How could they compete, with the encouragement which France and America afford to the interests of their fisheries? It can simply be proved by an extract from the Report of the Select Committee, British Channel Fisheries, August, 1833, at page 5:—"Your committee also think it right to observe that great attention on the part of the French Government appears to be paid to the extension and encouragement of the Channel fisheries, particularly as a nursery for their seamen, for which latter purpose they require so large a number as eighteen or twenty men to be carried on board each fishing vessel, and it is stated in evidence before your committee that bounties are also granted in aid of their fisheries. While to these causes, therefore, your committee attribute the greatly increased numbers of the French fishermen, and observe the decrease and distress of our own, they deem it their duty to suggest that all possible protection and encouragement should be promptly given to the English fisheries, not only in justice to the parties engaged in them, but, regarding them in a national point of view, as the most valuable source of supply to our navy."

The state that our navy and merchant service is in at present, a few extracts from the "Thunderer" of the day—the "*Times*"—may clearly indicate. In the admirable article of the 30th November last, full comments are made on a letter of Mr. James Hall, of Newcastle, "Training Ships for Homeless and Destitute Boys"—a well known authority, the "*Times*," observes, with matters connected with the sea. He tells us that "while the number and size of our ships are rapidly increasing, the number of Englishmen who make seamanship the profession of their lives is materially diminishing, and the proportion of foreign sailors in our navy is greatly increasing. In other words, the British sailor is making way for the foreign sailor. Within the last ten years it appears that the tonnage of our ships has increased 25 per cent., but the number of apprentices and boys entering the service has decreased 18 per cent., while the number of foreigners in the service has increased 76 per cent. At this moment more than a quarter, or 28 per cent. of the able seamen in our merchant service are foreigners. This is sufficiently unsatisfactory; but, even under these conditions, our ships are frequently most insufficiently manned, and is, probably, one cause of that lamentable increase of disasters at sea on which we recently commented." With respect both to our navy and to our trade, such a state of things is a subject of national concern, and we shall have reason to thank any one who can point out the cause, and suggest a remedy."

XXXIX.—*Report on the Collections made in Kerry.* By A. G. More, Esq., Assistant in the Museum of Natural History.

In pursuance of the resolution of the Natural History Committee, Mr. Andrews and I proceeded on the 24th of July to carry out the intended exploration of one of the remote and little known parts of Kerry.

Relying on the continuance of fine weather, which had lasted for many weeks in Dublin, we expected to find the same favourable conditions in Kerry; but we were fated soon to experience the proverbial uncertainty of weather in the west of Ireland.

With Dingle for our head quarters, arrangements were soon completed for a cruise into deep water, as we were anxious to commence by dredging as far from land as possible; but the very day after our arrival it commenced to blow and rain, and this broken weather continued at intervals during the greater part of our stay. Consequently our operations were often confined to collecting inside the harbour, or in the rock-pool, when, had the weather permitted, we might have secured a more profitable harvest on the open sea.

Notwithstanding these difficulties, we gained much information, and succeeded in collecting a fair number of various specimens of animals which were required for the Museum, and it is hoped that by continuing expeditions of the same nature, our native collection, at present far from complete, will by degrees be brought into a satisfactory condition.

The shores of Kerry are particularly rich in marine zoology, and could longer time have been spared, no doubt the results would have been still more satisfactory, and collections might have been made in other branches besides those to which our attention was especially directed.

Through Mr. Andrews' long and influential connexion with the fisheries of Dingle, we found no difficulty in procuring the services of nets, boats, and men, though this was at a season when the fishing is most productive, and it is well known how difficult it is to persuade the crews to take hearty interest in what appears to them an unprofitable waste of time.

That our expedition was not without some interesting results, in a scientific point of view, may be gathered from our being able to enumerate in our list at least one species of fish not before captured in Ireland, viz.—Montagu's Blenny (*Blennius galerita*), which was found inhabiting the rock-pools at the mouth of Dingle Harbour. This fish is very locally distributed on the British coasts, being recorded as occurring only in Devonshire and Cornwall, and this is a point that illustrates the great analogy between the south-west of England and the west of Ireland, whose Flora as well as Fauna are very similar.

Several rare Crustaceans were collected in the harbours of Dingle and Ventry. Among these the marbled swimming crab (*Portunus marmoreus*), previously known as Irish from Connemara only—for it appears from Mr. J. V. Thompson's specimen, that the crab so called by him, and which he captured near Cork, is really *P. holsatus*—*Portunus puber*, and *P. corrugatus*, *Ebalia Pennantii*, *Xantho florida*, and *X. rivulosa*. A rare and beautiful shrimp (*Hippolyte viridis*); *Comatula rosacea* in all stages of growth; the interesting Coral *Caryophyllia Smithii*, the curious *Eschara cervicornis* (locally called "coral"), and which is often brought up from deep water entangled in the fishermen's long lines, we had the pleasure ourselves of dredging at a depth of 28 fathoms; though at the sacrifice of our best dredge-net, which was torn to pieces on the rough rocky ground where alone this Polyzoon occurs. For the mention of many other interesting and local species it will be sufficient to refer to the list given at the end of this Report.

Though Botany was not our object, it was impossible not to notice many local and interesting species of plants, such as *Erodium moschatum*, *Carum verticillatum*, *Bartsia viscosa*, *Agrimonia odorata*, and Saxifrages, *S. Geum*, and *S. umbrosa*, of magnificent size growing at the water edge, with a luxuriance not to be found elsewhere.

A LIST OF ANIMALS OBSERVED IN KERRY, JULY AND AUGUST, 1868.

An asterisk (*) is prefixed to the names of those of which specimens have been placed in the Museum.

BIRDS:—

The Hen Harrier (*Circus cyaneus*). Dingle.
The Raven (*Corvus corax*). Connor Hill.
The Chough (*Coracia gracula*). Near Dingle.
The Rock Dove (*Columba livia*). Near Dingle.
The Gannet (*Sula bassana*). Dingle Bay.

FISHES:—

*Couch's Polyprion (_Polyprion cernium_). Dingle Bay.
Sapphirine Gurnard (_Trigla hirundo_).
Piper (_Trigla lyra_).
Grey Gurnard (_Trigla gurnardus_).
*Father-lasher (_Cottus bubalis_).
*Fifteen-spined Stickle-back (_Gasterosteus spinachia_).
Common Sea Bream (_Pagellus centrodontus_).
Mackerel (_Scomber scomber_).
*Horse Mackerel (_Caranx trachurus_).
The Doree (_Zeus faber_).
*The thick-lipped Grey Mullet (_Mugil septentrionalis_).
*The Atherine (_Atherinus presbyter_).
*Montagu's Blenny (_Blennius galerita_). Rock-pools at mouth of Dingle Harbour.
*Shanny (_Blennius pholis_).
*Spotted Gunnel (_Centronotus gunnellus_).
*Black Goby (_Gobius niger_).
*Double-spotted Goby (_Gobius Ruthesparri_).
*Freckled Goby (_Gobius minutus_).
*One-spotted Goby (var. of _G. minutus_).
*Ballan Wrasse (_Labrus maculatus_).
*Green-streaked Wrasse (young of _L. maculatus_).
*Cook Wrasse (_Labrus mixtus._)
*Corkwing (_Crenilabrus melops_).
*Gar-fish (_Belone vulgaris_). The young, when six or seven inches long, are netted for bait, under the local name of "Sperling." They were formerly described as a distinct species, under the name of _Hemiramphus europæus._
Salmon Trout (_Salmo trutta_).
*Common Trout (_Salmo Fario_, var. _gaimardi_).
*Sprat (_Clupea sprattus_). In pools left by the tide at Smerwick Harbour.
*Pilchard (_Clupea pilchardus_). Young, about six inches long, were taken in the seine, inside Dingle Harbour. These are the "sardines" of commerce.
Common Cod (_Gadus morrhua_).
Whiting-Pout (_Gadus luscus_).
*Pollack (_Gadus pollachius_). The young fry, about four inches long, were taken in the seine net with the young pilchards inside Dingle Harbour.
Coal-fish (_Gadus virens_).
Hake (_Merlucius vulgaris_).
Ling (_Molva vulgaris_).
*Three-bearded Rockling (_Motella tricirrata_).
*Flounder (_Pleuronectes flesus_).
*Dab (_Pleuronectes limanda_).
*Plaice (_Pleuronectes platessa_).

Fishes, *continued*:—

*Sole (*Solea vulgaris*).
Lump-sucker (*Cyclopterus lumpus*).
*Great Pipe-fish (*Syngnathus acus*).
*Deep-nosed Pipe-fish (*Syngnathus typhle*). Plentiful in Dingle Harbour.
*Snake Pipe-fish (*Syngnathus anguineus.*) Ventry Harbour.
*Worm Pipe-fish (*Syngnathus lumbriciformis*).
*Picked Dog-fish (*Spinax acanthias*).
*Thornback (*Raia clavata*).

*Mollusca:—

Saxicava arctica. Ventry Harbour.
Thracia villosiuscula. Off Blasquet Islands.
Tellina tenuis.
Tellina solida.
Mactra solida.
Mactra elliptica. } Off Blasquet Islands.
Lucinopsis undata. Ventry Harbour.
Artemis exoleta. Off Blasquets.
Venus striatula.
Lucina borealis. } Ventry Harbour.
Diplodonta rotundata.
Modiola modiolus.
Crenella marmorata. Ventry Harbour and Dingle Harbour.
Mytilus edulis.
Pectunculus glycymeris. Off Blasquet Island.
Anomia ephippium.
Pecten pusio. Ventry Harbour.
Pecten maximus.
Chiton cinereus.
Patella vulgata, var.
Patella pellucida. } Dingle Harbour.
Fissurella reticulata.
Trochus magus. Ventry Harbour.
Trochus umbilicatus. Dingle.
Littorina rudis.
L. littorea. } Dingle.
L. tenebrosa.
Aporrhais pes-pelecani. Ventry Harbour.
Scalaria communis. Dingle.
S—— Turtonæ. Ventry Harbour.
Natica monilifera.
Natica sordida. } Off Blasquet Island.
Purpura Lapillus.
Buccinum undatum.
Nassa reticulata.
N. incrassata. Dingle.

MOLLUSCAA, *continued*:—

Mangelia nebula, var. elongata. Off Blasquet Islands.
Cypræa europæa.
Scaphander lignarius (young). Off Ventry.
Ascidia mentula. Abundant in Dingle Harbour.
Molgula arenaria. Off Blasquet Island.

*CRUSTACEA :—

Stenorhynchus Phalangium. } Dingle and Ventry Harbours.
Inachus Dorynchus. }
Hyas araneus, Ventry.
Xantho florida (one). }
X. rivulosa (one). } Dingle.
Cancer pagurus. }
Carcinus mænas. Dingle and Ventry Harbours.
Portunus puber (one). Dingle.
P. corrugatus. Dingle.
P. arcuatus. Dingle and Ventry.
P. depurator (one). Ventry.
P. marmoreus (several). Ventry Harbour.
Ebalia Pennantii. Dingle, dredged.
Pagurus Bernhardus. Common.
P. Prideauxii. Off Blasquet Islands.
Porcellana longicornis. Dingle.
Galathea squamifera.
G. Andrewsii.
Homarus vulgaris.
Crangon vulgaris. Common.
C. tri-spinosus. Dingle Harbour.
Hippolyte, varians. Dingle and Ventry.
H— viridis. Dingle Harbour.
Palæmon serratus. Common in dredge and seine net.
P. Squilla. Common in rock-pools.

*ECHINODERMATA :

Comatula rosacea and the penduncculate young, formerly described under the name of *Pentacrinus europæus.*
Ophioglypha texturata.
Ophioglypha albida.
Ophiocoma rosula.
Uraster rubens.
Cribrella oculata.
Asterias aurantiaca.
Echinus sphæra.
Ech. miliaris.
Echinocyamus pusillus.

*ECHINODERMATA, *continued.**

Spatangus purpureus. }
Amphidotus roseus. } Off Blasquets.
Caryophyllia Smithii. Mouth of Dingle Harbour and in Dingle Bay.
Eschara cervicornis. Dingle Bay.

The Rev. Dr. Adams, well known for his skill in Conchology, has kindly favoured us with his opinion respecting a portion of shelly sand taken up on the outside of the Bay of Dingle, at a depth of 54 fathoms, and in which he finds the following species:—

Psammobia vespertina; Mactra stultorum (young); Mactra elliptica (young); Lutraria elliptica (young); Venus verrucosa (young); Venus striatula (young); Cardium edule (young); Patella vulgata (young); Trochus Montagui: Trochus tumidus; Trochus umbilicatus (fry); Phasianella pullus (fry); Rissoa Beanii; Rissoa punctura; Rissoa costata; Rissoa striata; Rissoa parva; Rissoa inconspicua; Rissoa soluta (young); Skenea planorbis; Turritella communis; Cerithium adversum; Scalaria clathratula (young); Eulima distorta (young); Eulima bilineata; Chemnitzia scalaris (fry); Odostomia interstincta; Odostomia spiralis; Eulimella acicula; Natica monolifera (fry); Cerithiopsis tuberculare (young); Nassa incrassata (fry); Mangelia teres (fry); Mangelia linearis var. scabra; Mangelia costata; Cypræa Europea; Cylichna truncata; Cylichna mammillata; Echinidæ (family) Clypeasteriæ; Echinocyamus pusillus.

The Chairman, SIR D. J. CORRIGAN, observed that the public were greatly indebted to Mr. Andrews for the great interest he had always taken in these investigations, which, if possible, should be renewed annually. It ought not to be forgotten, that Mr. Andrews had received very valuable assistance from Mr. More; in fact, it might be said that the whole talent of the Royal Dublin Society had been employed in this expedition. The Irish seas combined the productions of both north and south seas. The *Cottus Grænlandicus* and the Tunny, fish from the north and south meeting on the same ground, were not to be considered as mere curiosities, but rather in the light in which meteorologists regard the most trifling occurrences as valuable indications, and where these two fish are found together, no doubt valuable food could be obtained if sought for. Marine explorations were attended with great difficulties. Going out in a trawler involved many great sufferings. It was very difficult to combine sea-legs with a scientific mind. Mr. Andrews' results show the necessity of further investigations. Fish have their horizontal zones of distribution. Those found in deep, medium, and shallow water differ in their habits and food. If deep-sea fishes were placed in shallow water they became blind in a week, either from the diminution of the pressure on their eyes, or from the increase of light. Complete observations on the fish of the different zones would require years. Dr. Carte's discovery of the mode of killing sea animals by the gradual introduction of spirit into the vessels containing them was of great importance. Cuttle fishes, such as those on the table, were very difficult to preserve. He hoped that the public would soon have an opportunity of observing marine animals in a living state in an aquarium recently constructed in the Zoological Gardens in the Park. The sea fisheries of Ireland were of great importance. There were no Irish coast proprietors with strong interest and capital to encourage the fishermen. The question as to whether aid should be given to the Irish fisheries had been discussed in Parliament.

Harbours were very badly wanted, and it was the duty of the State to supply them. On a long extent of open coast harbours were a necessity, and unless harbours existed for every few miles, the fishermen could realize no profits. The Dublin fishermen have to row from ten to twelve miles, often against the tide, from below Bray to Kingstown, before they can sell their fish. We ought all to consider that harbours where boats could deliver their cargoes in any weather are wanted on every available spot all round the coast.

Dr. E. Percival Wright said that he thought the discussion had somewhat wandered from its legitimate subject. In addition to the fish obtained in the expedition, he had seen many interesting species new to the Society's collection, which had been obtained by Mr. More. Any one who was a sufficiently good sailor ought to pursue such investigations year after year. These explorations should not be confined to one spot; and no doubt Mr. Andrews and Mr. More, by extending the area of their operations, would obtain correspondingly greater results. He would suggest that the south-west coast should be dredged to 750 fathoms, where doubtless the forms recently obtained off the Faeroe Islands by Professor Wyville Thomson and Dr. Carpenter would be found.

Mr. Andrews said the principal object of his paper was to introduce a number of specimens of marine zoology that had been obtained for the Society's Museum, and not to enter into any detail whatever. In every case where money had been lent to fishermen of good character it had been well applied, and had put the men in a way of earning a livelihood. Along the northern coast there was no resident proprietary at all, and little could be done by the fishermen in disposing of their "catches."

XL.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

The Chief Secretary's Office, Adelaide, South Australia.

Adelaide Almanack . . . Directory, and Guide to South Australia for 1869, . . . By Josiah *Boothby*, Esq. (Government Statist).
12mo. *Adelaide* [1869]

The Author.

Alanus (Henr.), Emendationes Livianæ tertiæ . . .
12mo. *Dublinii, Londonii, item Edinæ*, 1869

El Observatiorio de Marina de S. Fernando

Almanaque Nautico par el año 1870, calculado de Órden de la Superioridad en el Observatiorio de la Cuidad de S. Fernando.
8vo. *Cādiz*, 1868

The Publishers, Messrs. Sampson, Low, Son and Marston.

Anglo-Colonial (The), a Monthly Magazine and Review of the Colonies. No. 1. 1st January, 1869.
8vo. *London*, 1869

The Executors of Arthur Ashpitel, by William George Groser, Esq., Storekeeper, Science and Art Department, South Kensington.

Ashpitel (Arthur . . .), Description and Key to the Views of Rome as it was and . . . is . . . drawn by Arthur *Ashpitel*, . . . and Chromo-lithographed by *Kell*, Brothers . . .
8vo. *London*, 1866

LORD TALBOT DE MALAHIDE.

Atlas National de France, No. 24 (Department de la Gironde). *Paris*, *s. a.*

THE AUTHOR.

Ball (Professor Robert, A. M.). Lecture Experiments to illustrate the Laws of Motion.

[From the Philosophical Magazine for May, 1869]. 8vo. *s. l.*, *s. a.*

THE AUTHOR.

Baruchson (Arnold). Beet root Sugar: . . . Directions to Agriculturists and Manufacturers . . . 8vo. *London and Liverpool*, 1868

LORD TALBOT DE MALAHIDE.

Beaurain (le Ch^{er}. de). Carte Topagraphique du Cours du Rhin depuis Basle jusqua Mayance . . . les mouvements . . . des Armées . . . pendant les Campagnes de 1674 et 1675. 6 cartes. *s. l.*, *s. a.*

THE AUTHOR.

Benmohel (N. S., A. M.). ΣΑΒΑΔΔΑΙΩΝ——סבטיוכ—Inscription de Trèves: avec une Digression sur l'Origine du Language. . . . 8vo. *Dublin*, 1868

DE LA PART DE L'AUTEUR, PAR M. JOHN SUFFERN, Windsor, Belfast.

Béron (Pierre). Transformation de l'Eau en Minerais. Aperçu général des details exposés dans la Physico-Chimie dont cet ouvrage est prospectus. . . . 8vo. *Paris*, 1868

JUSTIN WINSOR, Secretary of the Board of Trustees of the Public Library, Boston, Mass.

. . *Boston* (City of). Sixteenth Annual Report of the Trustees of the Public Library, 1868. 8vo. [*Boston*, 1868]

THE AUTHOR.

Briggs (Thomas). Proposal for an Indian Policy . . . The Dominant Wealth of the British Colonies. . . 8vo. *London*, 1868

JOHN RIBTON GARSTIN.

Burke (Oliver, A. B., T. C. D., Barrister-at-Law). The Abbey of Ross, its History and Details. . . 8vo. *Dublin*, 1868

LORD TALBOT DE MALAHIDE.

Capitaine (L., ..., et P. G. *Chanlaire*, . . .). Carte Géométrique des Routes de Postes de la Republique Francaise et des Pays qui l'avoisinent. *Paris*, *s. a.*

MR. BERNARD QUARITCH, 15, Piccadilly, London.

. . . *Catalogue* of Books, arranged in Classes, offered for sale by Bernard *Quaritch*, ... 8vo. *London*, 1868

THE PROVOST AND SENIOR FELLOWS OF TRINITY COLLEGE, DUBLIN.

Catalogue of Graduates who have proceeded to Degrees in the University of Dublin, from the earliest recorded Commencements to July, 1866, with Supplement to December 6, 1868. 8vo. *Dublin*, 1869

A. GÉRARD, LE BIBLIOTHÉCAIRE DE LA BIBLIOTHÈQUE DE LA VILLE DE BOULOGNE-SUR-MER.

Catalogue Méthodique de la Bibliothèque de la Ville de Boulogne-sur-Mer. 2 Tomes, 8vo. *Boulogne-sur-Mer*, 1865

Catalogue Methodique de la Bibliothèque de la Ville de Boulogne-sur-Mer, Premier Supplément au. Livres Imprimés. Tomes Premier et Second. 8vo. *Boulogne-sur-Mer*, 1865

THE LITERARY EXECUTORS OF THE AUTHOR.

Catlow (Joseph Peele, M. R. C. S., Edin.). On the Principles of Æsthetic Medicine, ... 8vo. *London*, 1867

LORD TALBOT DE MALAHIDE.

Chanlaire (P. G., ...). Carte Générale de l'Italie et de la Côte Orientale de la Mer Adriatique.

[. . Suite à la grande Carte de France et des Pays environnuns.] *a Paris*, *s. a.*

THE RIGHT HON. THE SECRETARY OF STATE FOR WAR.

Clarke (Captain A. R., R. E., F. R. S., &c., . . .). Determination of the Positions of Feaghmain and Haverfordwest, Longitude Stations on the great European Arc of Parallel. . . . 4to. *London*, 1867

E. PERCEVAL WRIGHT, M. D.

Clerici (Danielis Med. Doct.) Historia . . Latorum Lumbricorum intra Hominem & alia Animalia, Nascentium, ... 4to. *Genevæ*, 1715

LORD TALBOT DE MALAHIDE.

Dezauche (Ingenieur Geographique). Carte de La Lorraine, du Barrois, ... de Metz, Toul, et Verdun . . . .

Deux Parties, Septentionale et Meridionale. *a Paris*, 1790

REV. W. HICKEY, MULRANKIN RECTORY, BRIDGETOWN, WEXFORD.

Doyle (Martin). Notes and Gleanings relating to the County of Wexford, in its past and present Condition.

Part 3. *Dublin*, 1868
Part 4. *Dublin*, 1869
Part 5. *Dublin*, 1869

THE RIGHT HON. THE LORD TALBOT DE MALAHIDE, V. P. R. D. S.

Ferraris (Le Comte de, Lieutenant-General, . . .). Carte Chorographique des Pays-Bas Autriciens . . . . Gravée par L. A. *Dupuis*. . 25 Planches gr. *s. l.*, 1777

THE AUTHOR.

Fitzgibbon (Gerald, Esq., one of the Masters in Chancery in Ireland). Ireland in 1868, ... Second Edition, Revised. 8vo. *London and Dublin*, 1868

THE GOVERNMENT OF CANADA.

Geological Survey of Canada, Sir W. E. *Logan*, Director. —— Report of Progress from 1836 to 1866. . . . 8vo. *Ottawa*, 1866

THE AUTHOR.

Griffith (George). Our Classical Schoolmasters and Free Grammar Schools. A Satire. With . . . . Statistical and Historical Notes. 8vo. *Wolverhampton*, 1868

THE RIGHT HON. SIR W. GIBSON CRAIG, BART., LORD CLERK, REGISTER OF SCOTLAND.

Halyburton (Andrew, Conservator of the Privileges of the Scottish Nation in the Netherlands, 1492–1503), Ledger of. Together with the Book of Customs and Valuation of Merchandises in Scotland, 1612. 8vo. *Edinburgh*, 1867

CALEB D. BRADLEE, PASTOR OF THE CHURCH OF THE REDEEMER, BOSTON, MASS., U. S. A., LIFE DIRECTOR OF THE NEW ENGLAND HISTORICAL AND GEOLOGICAL SOCIETY AT BOSTON, AND FELLOW OF THE ROYAL SOCIETY OF NORTHERN ANTIQUITIES AT COPENHAGEN.

Hepworth (Rev. George H.). A Talk on Life Insurance. 12mo. *Boston*, 1869

THE PUBLISHER.

Irish Church Society's Journal. Vol. I. No. 2, May, 1869. 8vo. *Dublin*, 1869

COLONEL SIR ARTHUR PURVES PHAYRE, C. B., K. C. S. I.

Kammawá [Ordination Service of Budhist Priests].

THE AUTHOR.

Labatt (Hamilton, A. B., T. C. D.; . . .). Association for promoting the extension of the Contagious Diseases Act, 1866, . . . Reprinted from the Dublin Quarterly Journal of Medical Science, August, 1868. 8vo. *Dublin*, 1868

THE PUBLISHER.

Laicus. England and Ireland; or, Union without Communion. A Letter to the . . . . Earl of Derby, . . . 8vo. *Dublin*, 1868

COLONEL SIR ARTHUR PURVES PHAYRE, C. B., K. C. S. I.

Mahá Kádzáweng [History of Burma, in the Burmese Language].

MAJOR-GENERAL HALL, C. B.

Mairwara, the Story of; or, our Rule in India. 8vo. *London*, 1868

THE AUTHOR (BY JOHN BENNETT, ESQ., 21, WARREN'S-PLACE, CORK).

Marcel (C., Ancien Consul, Chevalier de la Legion d'honneur), L'Etude des Langues . . . . ou, L'Art de penser dans une Langue étrangere . . . . 12mo. *Paris*, 1867

THE AUTHOR.

Morgan (Francis, Law Agent). Rental of the Estates of the . . . . Lord Mayor, Aldermen, & Burgesses of Dublin, as . . . . laid down on Ordnance Maps. 1867. Folio. *Dublin*, 1867

THE EDITOR OF THE NATIONAL REVIEW.

National Review, of Politics, Literature, Art, and Social Progress. Vol. I.—Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. 4to. *Dublin*, 1868

THE ROYAL COLLEGE OF PHYSICIANS OF LONDON.

Nomenclature of Diseases drawn up by a Joint Committee appointed by the Royal College of Physicians of London (subject to Decennial Revision). 8vo. *London*, 1869

THE AUTHOR.

Prendergast (John P., Author of "The Cromwellian Settlement of Ireland"). The Tory War of Ulster, ... the Three Brennans . . of Kilkenny: . . . . Ireland . . . . A. D. 1660–1690. In two Parts. Part I. [For private circulation.] 8vo. *Dublin*, 1868

THE PHILOSOPHICAL SOCIETY OF GLASGOW.

Proceedings of the Philosophical Society of Glasgow. 1867–68. Vol. VI.—No. 4. 8vo. *Glasgow*, 1868

THE ZOOLOGICAL SOCIETY OF LONDON.

Proceedings of the . . . . . Zoological Society of London for the year 1867. 8vo. *London.*

THE SECRETARY OF THE QUEEN'S UNIVERSITY.

Queen's University Calendar, 1869. 12mo. *Dublin*, 1869

THE COMMISSIONERS OF THE RAILWAYS (IRELAND) COMMISSION, BY W. NEILSON HANCOCK, ESQ., LL. D., SECRETARY.

Railways (*Ireland*) *Commission*, Maps and Sections. Folio. *London*, 1868

MESSRS. HODGES, FOSTER, & CO., 104, GRAFTON-STREET.

Report (*Authorized*) of the *Church Congress*, held at *Dublin* on September 29th, 30th; October, 1st, 2nd, 3rd, 1868. 8vo. *Dublin*, 1868

L. SHELLY AND T. R. A. BRIGGS, SECRETARIES OF THE PLYMOUTH INSTITUTION, PLYMOUTH.

Report (Annual) and Transactions of the Plymouth Institution, and Devon and Cornwall Natural History Society. Volume III. 1867–68. 8vo. *Plymouth*, 1868

WILLIAM B. WEST, CONSUL OF THE UNITED STATES OF AMERICA.

Report of the Commissioner of Agriculture, for the year 1865. 8vo. *Washington*, 1866

Report of the Commissioner of Agriculture for the year, 1866. 8vo. *Washington*, 1867

THE CONSUL (IN DUBLIN) OF THE UNITED STATES OF AMERICA, WILLIAM B. WEST, ESQ.

Report of the Commissioner of Patents for the year 1863. Arts and Manufactures. Vols. I., II. 8vo. *Washington*, 1866

THE CONSUL (IN DUBLIN) OF THE UNITED STATES OF AMERICA, WILLIAM B. WEST, ESQ.

Report of the Commissioner of Patents for the year 1864. Arts and Manufactures. Volumes I., II. 8vo. *Washington*, 1866

THE CONSUL (IN DUBLIN) OF THE UNITED STATES OF AMERICA, WILLIAM B. WEST, ESQ.

Report (*Annual*) of the Commissioner of Patents, for the year 1865. Volumes I., II., III. 8vo. *Washington*, 1867

Report (Annual) of the Commissioner of Patents for the year 1866. Volumes I., II., III. 8vo. *Washington*, 1867

W. P. DYMOND, Esq., F. M. S., HON. SEC. ROYAL CORNWALL POLYTECHNIC SOCIETY.

Report (Thirty-sixth Annual, 1868), of the Royal Cornwall Polytechnic Society. 8vo. *Falmouth*, [1868]

THE REV. HUMPHREY LLOYD, D. D., PROVOST OF TRINITY COLLEGE, DUBLIN.

Report on . . . the Well Waters in Trinity College and its vicinity, . . . by James *Apjohn*, M. D., Professor of Chemistry in the University of Dublin, and John R. *Leslie*, M. A., Fellow of Trinity College. 8vo. *Dublin*, 1869

THE AUTHOR.

Reynolds (Dr. J. Emerson, . . .). A New Form of Spectroscope, for use in the examination of Minerals. . . Read before the Royal Dublin Society. . . December 16, 1867. 8vo.

THE AUTHOR.

Reynolds (Dr. J. Emerson). On certain Silicic Acids and the Anhydrous Mineral Silicates. [From the Philosophical Magazine for October, 1868.] 8vo. *s. l.*, *s. a.*

LORD TALBOT DE MALAHIDE.

Ridge (John, Sculps). Map of the County of Down. 2 Sheets. *s. l.* 1767

WILLIAM B. WEST, CONSUL FOR THE UNITED STATES OF AMERICA.

Russian America. Message from the President of the United States, ... transmitting Correspondence in relation to Russian America. 8vo. [*Washington*, 1868]

DIE COMMISSION ZUR HERAUSGABE DER KIELER UNIVERSITÄTS-SCHRIFTEN.

Schriften der Universität zu Kiel aus dem Jahre 1867. Band XIV. 4to. *Kiel*, 1868

THE CHIEF SECRETARY'S OFFICE, ADELAIDE, SOUTH AUSTRALIA.

Statistical Register [No. 7] of South Australia for 1867. . . . Folio. *Adelaide*, 1868

THE GOVERNMENT OF NEW ZEALAND, BY JOHN B. BENNETT, ESQ., REGISTRAR-GENERAL, WELLINGTON.

Statistics of New Zealand for 1867. Including the Results of a Census of the Colony, ... Folio. *Wellington*, 1869

THE AUTHOR.

Stewart (B.), ... Experiments on Aneroid Barometer made at Kew Observatory, ... (from *Proceedings of the Royal Society*, No. 103, 1868—p. 473-480.

L'ACADEMIE ROYALE DES SCIENCES DES LETTRES, ET DES BEAUX-ARTS DE BELGIQUE, PAR M. AD. QUETELET, LE SECRÉTAIRE PERPETUAL DE L'ACADEMIE.

Transactions.—Bulletins de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique. 8vo.
Trente-Sixième Année—2^{me} Série, t. xxiii.–xxiv. *Bruxelles*, 1867
Trente-Septième Année—2^{me} Série, t. xxv.–xxvi. *Bruxelles*, 1868

LONDON AND MIDDLESEX ARCHÆOLOGICAL SOCIETY.

Transactions of the London and Middlesex Archæological Society, Vol. III.—Part IX. 8vo. *London*, 1868

NATIONAL ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.

Transactions of the National Association for the Promotion of Social Science. Belfast Meeting, 1867. Edited by George Woodyatt *Hastings*, LL. B., ... 8vo. *London*, 1868

SOCIETE ROYAL DES SCIENCES A UPSAL, PAR M. AND. JON. ANGSTROM, SECRETAIRE.

Transactions. Nova Acta Regiæ Societatis Scientiarum Upsaliensis: Seriei Tertiæ Vol. VI. Fasc. II. *Upsaliae*, 1868

THE AUTHOR.

Traquair (Ramsay, H., M. D., ... Edinburgh). Description of Pygopteros Greenocki (Agassiz), ... From the Transactions of the Royal Society of Edinburgh, Vol. XXIV. 4to. *Edinburgh*, 1867

LORD TALBOT DE MALAHIDE.

Tyrolis . . . . *chorographice delineata* a Petro ANICH et Blasio HUEBER . . . . curante Ignat. *Weinhart* . . . . aeri incisa a Joa. Ernest MANSFIELD . . . . XX Tab. *Vienna*, 1774

Weiss (J. H.). Atlas de La Suisse, ...

No. 7,	Aarau,	1796
„ 8, 9,	„	1798
„ 10,	„	1798
„ 14,	„	1798

THE AUTHOR.

Wendt (Ernet Emil). Papers on Maritime Legislation. With . . . the German Mercantile Law relating to Maritime Commerce. 8vo. *London*, 1868

REV. BEAVER H. BLACKER, A. M., RURAL DEAN, DUBLIN (SOUTH), INCUMBENT OF BOOTERSTOWN.

West (Matthew, A. M., Curate Assistant of St. Mary's, Donnybrook, and Chaplain to the Right Rev. Isaac, Lord Bishop of Cork). Poems, &c., on Several Occasions. 4to. *Dublin*, *s. a.*

Le Marquis de Lavalette, Minister of Foreign Affairs, France, by the hand of M. Geo. Livio, French Consul in Dublin, 51, Upper Leeson-street.

1. Desains, Thearie de la Chaleur. *Paris*, 1868
2. Milne Edwards, Zoologie, *Paris*, 1867
3. Delaunay, Progrès de l'Astronomiè, *Paris*, 1867
4. Duchartre, Botanique Physiologue, *Paris*, 1868
5. De Sacy, le Progres des Lettres, *Paris*, 1868
6. Geffroy, Zeller, et Thiénot, sur les Études historiques, *Paris*, 1867
7. Études relatives a l'Egypt et a l'Orient, (Gigniaut), *Paris*, 1867
8. Études Classiques et du Moyen Age, *Paris*, 1868
9. Demogeot et Montucci, de l'Enseignement secondaire en l'Angleterre et en Écosse, *Paris*, 1868
10. Rapport du Commisaire General de l'Enquéte Agricole, sur les resultats de l'Enquéte, *Paris*, 1868
11. Volumes (19) de l'Enquette Agricole, viz. 1^{ere}, 2^{e}, 3^{e}, 4^{e}, 5^{e}, 6^{e}, 8^{e}, 9^{e}, 11^{e}, 12^{e}, 14^{e}, 16^{e}, 17^{e}, 19^{e}, 20^{e}, 23^{e}, 26^{e}, et 28^{e}, et 24^{e} Cironscriptions, *Paris*, *v. a.*, 1867–68, &c.
12. Enquete Agricole, $4^{\text{trième}}$ Seriè, Documens recucillis a l'Etranger tome 1, 2, *Paris*, 1868
13. Enquete Agricole $3^{\text{sième}}$ Serie, Dépositions Orales, Documents recueillis a l'Estranger, *Paris*, 1867

(Signed) Edw. Richards Purefoy Colles,
Librarian.

June 3rd, 1869.

NATURAL HISTORY MUSEUM.

S. G. **Percival**, Esq., *Severn House, Henbury, Bristol*:—Twelve fine specimens of Rutile from Co. Mayo.

William Frazer, Esq., M. D., 124, *Stephen's-green*:—A fine specimen of a rare *Bulimus* from Old Calabar, West Africa.

Sir F. Leopold M'Clintock, R. N., *Merrion-square*:—A bottle containing a number of Fish collected by himself in the West Indies.

W. R. **Atkins**, Esq., 5, *Merrion-square*:—A small specimen of the Angel Shark (*Squatina angelus*), taken in Dublin Bay.

LIEUT. ARTHUR G. RIALL, H. M. S. "Royal George":—A remarkably large female Sparrow-hawk (*Accipiter fringillarius*).

PHINEAS H. RIALL, Esq., *Old Connaught, Bray*:—A number of Skins of Birds collected in India and the Moluccas.

COLONEL SANKEY, 9*th Regt.*:—A case containing a series of Earths and Fossils, illustrating their natural position as observed at Yokohama, Japan.

ROBERT BARKER, Esq., 101, *George's-street, Limerick*:—Four Otoliths, or Ear-bones, found on the coast of Madras; and a small Chinese Book.

W. CORBET, Esq., *Castle Connell, Limerick*:—A fawn-coloured variety of the common Sparrow (*Passer domesticus*), obtained near Castle Connell.

LIEUT. FRANCIS BARKER, R. A.:—A Shield, Sword, and Spear, taken at Magdala, Abyssinia.

HENRY WOODWARD, Esq., *British Museum*:—Eight casts of Palæozoic *Crustacea*, viz., *Stylonurus scoticus* (two specimens); *S. Powriei* (two specimens); *Pterigotus anglicus* (four specimens); *Europterus nanus* (one specimen).

R. P. WILLIAMS, Esq., *Dame-street*:—A specimen of the New Holland Goose (*Cereopsis Novæ-Hollandiæ*), which had died in Mr. Williams' aviary.

J. THORNTON, Esq., *Bray*:—A singular Nodule of Sandstone from the Queen's County.

JOLIFFE TUFNELL, Esq., *Lower Mount-street*:—A Monkey from India.

THOMAS E. CARTE, Esq., *Glentworth-street, Limerick*:—A specimen of the Spanish Lobster (*Galathea squamifera*).

PROFESSOR DICKIE, *University of Aberdeen* (through A. G. More, Esq.): —A large specimen of the deep-sea Coral (*Oculina prolifera*), obtained six miles westward of the Isle of Skye.

GEORGE SMITH, Esq., Jun., 104, *Grafton-street*:—A pale-coloured variety of the Skylark (*Alauda arvensis*).

SIR DOMINIC CORRIGAN, M. D.:—A Mocking Bird (*Mimus polyglottus*) from Florida.

COLONEL SIR ARTHUR P. PHAYRE, C. B., K. S. I.: —Three imperfect Human Skeletons, two males and one female, from the Andaman Islands, Bay of Bengal.

REV. JOHN BEATTY, 52, *Leeson-street*:—Two Flying Foxes (*Pteropus Edwardsii*), and five Birds' Skins from India.

W. DIGBY LONGFIELD, Esq., M. D., Assistant-Surgeon, H. M. S. "Spitfire":—A leathern Cartridge-box and Belt from Abyssinia.

JOHN HAMILTON, Esq., 14, *Pembroke-road*:—A Snake.

Alexander G. More, Esq., *Glasnevin*:—A fine specimen of the rare British Crustacean (*Squilla Desmarestii*), taken off Bembridge, in the Isle of Wight.

Charles Gray, Esq., *Victoria* (per Dr. C. P. Croker):—A Dress used by the Lubra tribe, and six specimens of Auriferous Quartz.

—— Murray, Esq.:—A singular specimen of Calcareous Spar.

George Johnston, Esq., *Rotundo Hospital*:—A Mummy Head from the Pyramids of Ghizeh; a Parrot Fish (*Tetraodon*) from Cape Coast, Africa; the Skin of an Ornithorhynchus from Van Dieman's Land; and the Skin of an *Echidna hystrix* from New South Wales.

Lord Powerscourt, *Powerscourt, Enniskerry*:—A Stag (*Cervus elaphus*), and the Skeleton of an Otter (*Lutra vulgaris*).

Capt. Cary, *Kingstown*:—A specimen of the Bell Bird (*Procnias carunculatus*), and some *Lepidoptera* collected in Italy.

Hon. Mrs. Preston:—A Sea Mouse (*Aphrodite aculeata*), found on the shore near Gormanstown, Balbriggan.

William Carter, Esq., 11, *Elgin-road*:—A fine specimen of a Cuttle Fish (*Ommastrephes sagittatus*), found on the strand at Merrion.

Edwin Brown, Esq., *Burton-on-Trent*:—Six specimens of foreign *Carabidæ*.

Richard P. Williams, Esq., 38, *Dame-street*:—A Gosling of the *Cereopsis* Goose.

Ditto:—A Gosling of the ashy-headed Goose (*Chloephaga poliocephala*), the first hatched in Ireland.

James Martin, Esq., M. D., *Portlaw, Waterford*:—Some specimens of Fossil Woods; a *Phalangista pygmæa*, or Flying Mouse; and a few Shells and Minerals from Australia.

Alexander Carte, M. D., F. L. S., *Director*.

June 2nd, 1869.

AGRICULTURAL MUSEUM.

Hon. C. J. Trench:—Book containing Plans of improved Cottages.

Sir Dominick J. Corrigan, Bart:—Portable Flax Thread Reel procured in Germany.

Messrs. Sutton & Sons, *Royal Berkshire Nurseries, Reading*:—Useful Lists and Catalogues.

James Smith, Esq., *Royal Marine Terrace, Bray*:—Samples of a new variety of Wheat and Oats.

Edward Purdon, Esq., T. C., 23, *Bachelor's-walk, Dublin*:—Various specimens of Flax, and Flax Seed:

John Whitehead, Esq., *Preston, Lancashire*:—Illustrated Catalogues, &c.

Edward Harden, Esq., *Victoria Works, Strangeways, Manchester*:—Specimens of Superior Feeding Cake.

John Wight, Esq., *Merchant, Eustace-street*:—Specimens of Artificial Manures, Green Crops, &c.

Andrew Corrigan, *Curator*.

BOTANIC GARDEN.

Rev. S. Madden, *Kilmanagh Rectory, Callan*:—Parcel of Seeds from New Zealand.

Miss Porter, *Kilskerry Rectory, Ballinescaullen, Co. Fermanagh*:—4 kinds of seeds.

Messrs. Handyside and Davidson, *Nurserymen, Musselburgh*:—48 choice new Dahlias.

Meadows Taylor, Esq., *Harold's Cross*:—Two kinds of Indian Seeds.

Mr. Frazer, *Nurseryman, Comley Bank, Edinburgh*:—27 rare Plants.

Mr. M'Nab, *Royal Botanic Garden, Edinburgh*.—53 scarce Plants.

D. E. Barret Kearney, Esq., *Staff Surgeon, Gofton Hall, Finglas*:—1 plant, 6 kinds of seeds from Africa, and two examples of rare Woods for Botanical Museum.

Peter Denny, Esq., *Dumbarton*:—*Two fine New Zealand Tree Ferns.*

Ditto:—*One fine New Zealand Tree Fern.*

M. Stelzner, *Nurseryman, Ghent*:—4 rare Ferns.

Charles Ensor, Esq., 4, *George's-place, Dublin*:—One basket filled with fine plants of *Sarracenia purpurea*, direct from Newfoundland. Also, cones of *Pinus Banksiana*, from Canada, for Botanical Museum.

Rev. H. Ellacombe, *Bitton Vicarage, Bristol*:—33 rare Plants.

Mr. Thompson, *Seed Merchant, Ipswich*:—9 scarce herbaceous Plants.

Max Leichtlin, *Carlsruhe, Duchy of Baden*:—3 rare Plants.

Henry Boyle, Esq., *Ellen House, Ambleside*:—2 packages of American Seeds.

Miss Maguire, *Innismore Delgany:*—12 kinds of Australian Seeds.

Miss Webb, *Winslow-terrace, Rathgar:*—One rare Cape Bulb.

Charles Moore, Esq., Director Botanical Garden, *Sydney, N. S. W.:*—Box of Plants of the rare *Leptopteris superba*, from New Zealand.

Mrs. Brook, *Lough Eske Castle, Lough Eske, Co. Donegal:*—Package of Seeds from Canada.

—— **Smith, Esq.**, M. R. D. S. (No address left):—Package of Seeds from Abyssinia.

F. W. Brady, Esq., M. R. D. S., *Leeson-street:*—24 kinds of Seeds from China.

Mrs. Henderson, 42, *Fitzwilliam-place:*—13 kinds of Spores of Ferns from East Indies.

Dr. Martins, Director Botanical Garden, *Montpellier, France:*—100 kinds of Seeds.

Mr. Hartland, Nurseryman, *Cork:*—Plant of variegated variety of *Wellingtonia gigantea.*

Herr Ortgies, Inspector Botanical Garden, *Zurich:*—60 kinds of Seeds.

Mr. Turner, *Hammersmith, Ball's-bridge:*—12 kinds of spores of Ferns from Japan.

Dr. Thornton, *South Camp, Aldershot:*—71 kinds of Seeds from Cape of Good Hope.

The Directors of Museum of Natural History, *Paris:*—170 kinds of Seeds.

Major Clark, *Walton Park, Daventry, England:*—Seeds of 7 kinds of Cotton, and Cotton from New Orleans, vine kind; also cuttings of new varieties of Coleus.

Dr. Calmiero, *Botanical Garden, Madrid:*—160 kinds of Seeds.

Signor Todaro, Director, *Botanical Garden, Palermo:*—190 kinds of Seeds.

Dr. Caspeery, Director, *Botanic Garden, Konigsberg, Prussia:*—130 kinds of Seeds.

May 4, 1869. **D. Moore**, *Director.*

INTELLIGENCE.

EVENING SCIENTIFIC MEETINGS.

MONDAY EVENING, NOVEMBER 16, 1868.

DR. HERMANN R. DE RICCI in the Chair.

MR. W. F. KIRBY, Assistant in the Museum of Natural History, read a paper on the Ailanthus-feeding Silk-worm, *Attacus* or *Bombyx Cynthia*. (Published.)

MR. A. G. MORE, Assistant in the Museum of Natural History, exhibited specimens of *Scirpus pavulus*, found by him near Arklow, Co. Wicklow. The plant is extremely rare, if not altogether extinct, in England, and it is by no means common on the Continent.

DAVID MOORE, Ph. D., Director of the Botanic Garden, exhibited a branch of Hawthorn—*Cratægus oxycanthus*—in full flower. The tree from which the branch was taken usually flowers at Christmas, but it flowered much earlier this season. He also showed a white-berried Hawthorn, and a white-berried Celastrus, also the yellow-bound Holly.

DR. J. EMERSON REYNOLDS, Keeper of the Minerals, and Analyst, exhibited some striking experiments, showing by coloured films thrown on the screen, the spheroidal condition of water, and explained how it has caused the explosion of steam boilers. Dr. Reynolds also exhibited photographs of the great Melbourne Telescope, constructed by Mr. Grubb; and of the Moon, as taken by means of that instrument. He also exhibited and explained the action of Schiebler's apparatus for estimating Carbonic Acid, also Springel's Air-pump.

MONDAY EVENING, DECEMBER 21, 1868.

SIR ROBERT J. KANE, LL.D., F.R.S., in the Chair.

MR. ARNOLD BARUCHSON read a paper on the reintroduction of Beet Sugar manufacture into Ireland. (Published.)

Dr. J. **EMERSON REYNOLDS**, Keeper of the Minerals and Analyst, made a communication on a new product of the action of Heat on Sulpho-cyanite of Ammonia. (Published.)

DR. CRUISE exhibited an electro-motor Engine of sufficient strength to turn a small lathe, or to work a sowing-machine.

An unusually fine specimen of Rutile, found in the county Mayo; also a specimen of Wavellite were exhibited.

It was announced that in consequence of the lateness of the hour, Dr. J. Emerson Reynolds had consented to postpone his promised paper "On a New Product of the Action of Heat on Sulpho-cyanite of Ammonium."

SIR ROBERT KANE then vacated the chair, which was taken by Mr. Waldron.

DR. CRUISE then exhibited his model of a new electro-magnetic machine. He had had it in work a year and a half. In workshops, moderate power, combined with steadiness, was frequently required, which precluded the use of a lathe or other ordinary machines. Steam was objectionable on account of the length of time required to get it up, and the difficulty of obtaining a sufficient supply of water. Even the Vartry water, if used for this purpose, would cost 4*s*. per hour. Gas engines were much used abroad, but they soon clog in proportion to the amount of carbon in the gas; and Dublin gas is highly carbonaceous. They, therefore, require too frequent cleaning. The American hot-air engine also failed from requiring too frequent cleaning and reviewing. Electricity had been tried unsuccessfully, and in Paris electro-motor engines are now abandoned. When in Paris, Dr. Cruise was told that the only engine of the kind shown him could be made under £280. The power of the electro-magnet was too short, but with Mr. Yates' assistance, Dr. Cruise had experimented till he had found a rotatory engine to succeed. The armature was only attracted for a short time, but by the multiplication of armatures a nearly constant force is attainable. The credit of the original design is due to Dr. Callaghan of Maynooth. Three magnets were employed, placed at the angles of a triangle, and between them is a wheel with the circumference cut away, five armatures are placed between the magnets, and a current is passed through them, and the magnets being successively magnetized and demagnetized, alternately attract and repel the armatures. The engine exhibited had a quarter of a man's power; but the power would easily be doubled by doubling the battery. It will work without observation for 24 or 36 hours. It will polish lenses, &c., and works a small lathe well. The machine was then exhibited in motion. It was stopped by turning off the current, and the power was regulated by the depth of immersion of the plates. It will work for 12 hours continuously. Constant continuous power is best obtained by Call's battery. The cost of charging the battery is about 2*s*. 6*d*. each time.

The following minerals were on the table for exhibition:—An unusually fine specimen of Rutile from the county of Mayo; a specimen of Irish Wavellite.

MONDAY EVENING, JANUARY 18, 1869.

Rev. PROFESSOR GALBRAITH in the Chair.

MR ALLOWAY read a paper "On Peat-coal and its Profitable Utilization." (Published.)

MR. THOMAS E. FLANNELLY read a paper "On Weights and Measures, and Commercial Arithmetical Calculations."

DAVID MOORE, Ph. D., Director of the Botanic Garden, read a communication giving an account of a successful experiment in the cultivation of Kohl-Rabi. (Published.)

Dr. MOORE also exhibited a fine specimen of the Chocolate plant (*Theobroma cacao*) in fruit, grown at the Botanic Garden. *Theobroma cacao*, exhibited, is the plant, the seeds of which constitute the principal ingredient in chocolate. It belongs to the natural order Byttneriaceæ, which comprises some plants with rather strong flowers, but those of the chocolate are the reverse of effective. They are very small, and grow from the bare, leafless, hard stem, being easily passed over by an ordinary observer, even when in full flower. In European collections fruit is seldom produced under cultivation, this being the first time it has been known to do so in Ireland, or probably in Great Britain. The seed, when simply bruised, is the cocoa of the shops; when reduced to a paste, sweetened with sugar, and flavored with vanilla, it becomes chocolate, of which from one million and a half to two millions lbs. are yearly consumed in the British islands. In Spain it constitutes a very large proportion of the food both of the middle and lower classes of the inhabitants.

MONDAY, FEBRUARY 1, 1869.

SIR DOMINICK J. CORRIGAN, Bart., in the Chair.

Mr. ANDREWS, Chairman of the Natural History Committee, read a communication "On the Ichthyology of the South-west Coast of Ireland, and on Collections of Zoological specimens obtained for the Society during the Summer and Autumn of the year 1868, with remarks upon the Irish Fisheries." The paper was illustrated by a large number of the specimens obtained by Mr. Andrews, and Mr. More, one of the Museum assistants, when on the expedition.

MONDAY, FEBRUARY 15, 1869.

G. JOHNSTONE STONEY, A. M., in the Chair.

DR. J. EMERSON REYNOLDS, Keeper of the Museum and Analyst, read the following papers, entitled—

1. "Further Notes on the Estimation of Soluble and Insoluble Phosphates in Superphosphate of Lime and other Phosphatic Manures." (Published.)

2. "On a Convenient Method of Extracting Oil and Fat in effecting the analysis of Linseed, Rapeseed, and other Feeding Cakes."

ROBT. S. BALL, A.M., Professor of Applied Mathematics, Royal-College of Science, exhibited a remarkable Experiment upon a fluid removed from the action of gravity. The fluid used was oil, which was suspended in a mixture of alcohol and water, of the same specific water as oil. The oil formed a spherical mass, and librated in the mixture. On passing a spindle through the oil, and working it, the oil revolved, at first becoming flattened at the "poles," and ultimately forming a ring separated entirely from the spindle.

MONDAY, MARCH 15, 1869.

HENRY DIX HUTTON in the Chair.

GEORGE JOHNSTONE STONEY, A.M., F. R. S., read a paper "On a Universal Money of Account, and a National System of Coinage."

DR. J. EMERSON REYNOLDS exhibited some remarkable Experiments with the Magnesium Light.

DR. E. PERCEVAL WRIGHT, Curator of the University Museum, exhibited a set of the fruit of the Coco-de-mer (*Laodicea Seychellii*); a set of Baskets made from the fibre of the leaf of the same palm. Specimens of *Scolopelia peli*, a rare Owl from the Gambia, and of a large Soldier Crab (*Bergen latro*), from the East Indies, were also exhibited.

MONDAY EVENING, APRIL 19, 1869.

JOHN EUSTACE, M.D., in the Chair.

ROBERT S. BALL, A.M., exhibited, by means of the Lime-light, numerous slides, illustrative of Mr. Huggins' researches on the Spectra of the Stars.

DR. J. EMERSON REYNOLDS exhibited the absorption Spectrum of the supposed new element, Jargonium.

MR. J. V. ROBINSON exhibited numerous Etched Negatives, produced by a new process for Photographic Printing.

MONDAY EVENING, MAY 31, 1869.

GEORGE JOHNSTONE STONEY, A. M., F.R.S., in the Chair.

Dr. ALEXANDER MACALISTER, Honorary Professor of Artistic Anatomy, read a paper "On the Typical Irish Skull."

DR. J. EMERSON REYNOLDS, Keeper of the Minerals and Analyst, explained and illustrated, by means of the Lime-light, a new mode of showing the absorption of Hydrogen by Palladium.

MR. STEPHEN YEATES exhibited the new Zirconium Light, as at present used at Paris.

DISTRIBUTION OF PRIZES TO THE STUDENTS OF THE SCHOOL OF ART.

THE Annual Distribution of Prizes awarded to the Students of the School of Art took place before a most numerous audience, in the Lecture Theatre, at 9 o'clock, P. M., on Thursday, January 28, 1869.

HIS EXCELLENCY EARL SPENCER, K. G., Lord Lieutenant of Ireland, who was received by the Council and Fine Arts Committee, took the chair as President of the Society.

His Excellency was accompanied by the Countess Spencer, and attended by Lord and Lady Charles Bruce; Charles Roundall, Esq. (Private Secretary); Colonel Caulfield (Comptroller); and the Aid-de-Camp in Waiting.

Amongst those present were—

Right Hon. Sir William Carroll (Lord Mayor) and the Lady Mayoress; Right Hon. the Lord Chancellor; Right Hon. Lord Strathnairn, G. C. B., K. S. I., Commander of the Forces in Ireland, attended by his Aide-du-Camp.

Mr. GEORGE WOODS MAUNSELL, one of the Secretaries of the Society, said it became his duty to open the proceedings which his Excellency had been kind enough to preside over that evening. Their first duty, on that, his Excellency's first appearance as President of their time-honoured institution, was to bid him the hearty welcome which the Queen's representative had always obtained in Ireland. They did not disguise from themselves or from His Excellency that they had at all times parted from old friends with regret, and especially they had parted with regret from the distinguished nobleman who had filled the office as their Vice-President, occupying the high office of Lord Lieutenant, which His Excellency now filled. But that regret was somewhat tempered when they found Her Majesty had selected to fill the post of Viceroy in Ireland a nobleman whose own taste and the taste of whose family were so much in unison with the great objects of this Society. He (Mr. Maunsell) had had lately the honour of attending before His Excellency with the address voted by the Society, which unveiled in a short space the great objects of the Society, which they were prepared to carry out—viz., agriculture, fine arts, botany, natural history, and the maintenance of a great public library for their fellow-citizens of this metropolis. They hoped, as the year rolled round, that they would have the pleasure of seeing His Excellency at some of their gatherings, which indicate one of their great departments—that of agriculture; and if the renown which belonged to His Excellency's house and the person of the distinguished statesman whose name His Excellency bore was still kept up, they hoped His Excellency would favour them by competing for their prizes at the April Show, which were now second to none in the length and breadth of the land. Later in the year they might hope to see His Excellency, when, as a distinguished master of the fox-hounds, it might be their pride and pleasure to introduce to him a class of animals which nothing in Northamptonshire would stop, and which would carry the renown of the Irish horses over the length of the sister country, as well as over this. But he should not digress from the object which they were assembled for that night. They were met on an occasion of still greater interest to those who made art their study, and also stood there for competition with all the schools of other institutions—a competition at which Dublin need not hang its head. It would be the duty of his friend who was to follow to go more into details on the different matters connected with this training school, and with the competition which His Excellency was then to distribute the prizes for. He might mention, however, that this school had been in existence for something like 140 years; that they had connected with it at different times artists whose reputation has become European, and who, when they had passed away, had left regrets more enduring than brass or marble. They had among their scholars Sheas and Danbys, and they had the name of Foley, who is now foremost in England, and others who sustained the reputation of the school wherever they went. Some two years ago, in deference to a vote of the House of Commons, the schools of art were placed on a new footing. The standard was raised up above what it had been. It was gratifying to state that, whatever were the prizes won by the students of this school under the old system, that the prizes had largely increased since the standard was raised. When he informed His Excellency—which he did with some pride, as an officer of the Society—that the Dublin School stands first in proportion to the number of awards to it as regards its number of students of all the schools in the United Kingdom, including South Kensington, and when he told His Excellency it stood above all in the number of national awards it had obtained, he thought he bespoke for this school a character which nothing he could say could add to. Leeds carried off one national award for 409 pupils; Glasgow for 340; Birmingham for 202; Lambeth for 80; South Kensington for 588; Edinburgh for 69; and Dublin had won for 39 pupils—standing thus considerably at the head of all the schools of the United Kingdom for these awards, which are the highest as regards merit, by national competition. The Report went so fully into the other matters, that he did not feel justified in trespassing further on His Excellency's time. He would, therefore, beg to introduce Lieutenant-Colonel Adamson, Chairman of the Fine Arts Committee.

Lieut.-Colonel Adamson then addressed his Excellency, and having thanked the Lord Lieutenant and the Countess Spencer for the honour they had conferred upon the Society and the pupils by attending that evening to distribute the prizes, said that he would not trouble his Excellency by referring at any length to the history of the schools. He thought, however, he might mention that early in the last century they were endowed by the Irish Parliament with £500 a year, which was continued till 1829, when the Board of Trade granted an addition of £500 per annum for the endowment of Schools of Design with a view of applying art to manufacture. In 1854 they were placed under South Kensington, and they were fully sensible of the great advantages they derived from their connexion with that institution, and were anxious to continue it, but under that system, and without a considerable income from the Royal Dublin Society, the schools could not be carried on: the fees being in many cases almost nominal, particularly in the case of the artisan class, they found it impossible to make the schools self-supporting. Through the medium of the Royal Dublin Society's Schools, instruction was given to upwards of 3000 pupils, and it had been found in every way useful and beneficial. There was one point which caused embarrassment, and that was the difficulty which the artisan class sustained in proceeding to South Kensington for instruction, from want of time and money. To remedy this, the Committee were very anxious to have a museum attached to the school, from which all classes would be enabled alike to derive advantage and instruction. At present they were unable to effect that object, but they looked forward to eventually being placed in the same position as the Metropolitan School in Scotland, which, at the time of its affiliation with the Department of Science and Art, was made the recipient of a special grant. They were also most anxious to establish a training school for teachers in connexion with the School of Art of the Royal Dublin Society. It was most gratifying to know that through the influence of these schools the taste for art had been increased, not only in Dublin, but through many parts of the country. Lieutenant-Colonel Adamson then proceeded to read the following Report of the Chairman and Committee of Fine Arts for the year 1868:—

REPORT OF THE CHAIRMAN AND COMMITTEE OF FINE ARTS FOR THE YEAR 1868.

In presenting our Report for the year 1868, we have, in the first place, to request your attention to the great success which has attended the School of Art of the Royal Dublin Society during the year 1868, resulting from a well-considered system of instruction.

We beg to point to the Tables appended to this Report, the figures of which express more strongly than we can do within the limits of a Report, the results of this year's competition, and the position occupied by the Dublin School of Art, as compared with the other great Art Schools of the United Kingdom, taking, as it does, a position second only to those at South Kensington.

We have in the next place to refer to the increase of Students during the past year, and it is most gratifying to find that the number of those who are connected with pursuits into which Art enters as an element have very considerably augmented—indeed, there is evidence of a desire on the part of all classes to take advantage of the instruction afforded by our institution.

It is to be hoped that the empirical teaching of so-called drawing at one time so prevalent, and still too common, may ultimately disappear, giving rise, as it does, to erroneous ideas, and preventing the reception of more correct views, which can result only from well directed efforts and investigation.

Much attention has been given during the year to Designing for Manufactures, more particularly Tabinets, Muslins, Wall Decorations, Carpets, Pottery, &c.

The number of Students modelling in clay has increased; a more complete training in the elementary branches of Art is insisted upon than in former years; and it is found that Students are becoming more convinced of the necessity of a complete mastery of elementary work as preliminary to any advanced study whatever.

Numerous classes in public and other Schools continue to be instructed in Drawing through the agency of the Central School of Art.

The examination of such classes took place in May last.

The attendance of Students at the Central School during the past year has been 519, consisting of 264 males and 255 females, showing an increase of 87 over the year 1867.

The number of Students attending the Artisan Classes has been 201, of which 187 were males, and 14 females.

The total receipts in fees amounted to £470 14*s.* 1*d.*, including £9 from the Department of Science and Art on account of one year's instruction of three free Students.

The average fee per Student for 1868 is 18*s.* 2*d.*

The following Table shows the attendance of Students and the fees received for the years 1862 to 1868, both inclusive:—

	Number of Students.	Amount of Fees.		
		£	*s.*	*d.*
1862	330	265	16	4
1863	386	279	15	9
1864	436	388	14	11
1865	484	416	15	6
1866	431	418	1	4
1867	432	458	5	10
1868	519	470	14	1

The following is an analysis of the occupation of Students:—

[In cases of Students without a trade or profession, that of their parents is given.]

Agents, 5; Architects, 7; Art Students, 23; Army Officers, 13; Bankers, 6; Baronet, 1; Barristers, 20; Bog Oak Carver, 1; Builders, 22; Butchers, 2; Cabinet Makers, 5; Carpenters, 26; Civil Engineers, 8; Clergymen, 34; Clerks, 47; Coach Builder, 1; Coach Painters, 3; Cutler, 1; Dentists, 2; Designer, 1; Distillers, 2; Dyer, 1; Earl, 1; Editors, 3; Engravers, 3; Farmer, 1; Fishing Tackle Maker, 1; Governesses, 7; Gun Makers, 2; Hatter, 1; House Painters, 6; Iron Mongers, 7; Jewellers, 4; Knights, 2; Labourer, 1; Landed Proprietors, 37; Librarian, 1; Lithographer, 1; Medical Doctors, 32; Mechanical Engineers, 6; Members of Parliament, 2; Merchants, 23; Moulders' Pattern Makers, 2; Optician, 1; Photographers, 6; Pocket Book Maker, 1; Police Superintendent, 1; Printers, 4; Professors, 6; Sculptors, 5; Shop Keepers 20; Silver Smiths, 2; Solicitors, 31; Stone Carver, 1; Tailors, 2; Tutors, 2; Upholsterers, 5; Viscount, 1; Wood Carvers, 3; Unspecified, 54.

The Local Examination was held on the evenings of the 10th, 11th, and 12th of March. The following gentlemen, members of the Council, and of the Fine Arts Committee, conducted the examination, viz.—

Robert Griffin, Esq.; Robert Callwell, Esq.; William M'Kay, Esq., LL. D.; Evory Kennedy, Esq., M. D.; Lieut.-Colonel Adamson; John Shaw Smith, Esq.; John R. D'Olier, Esq.; Sir Robert Harty, Bart.; and William Edward Steele, Esq., M. D., Secretary.

164 Students presented themselves for examination in the following subjects:—Practical Geometry; Freehand Drawing; Perspective; Model Drawing; and Projection.

The number of Students examined in the various subjects being as follows:—Geometry, 72; Freehand, 117; Perspective, 64; Model Drawing, 58; Projection, 6.

One hour was allowed for each exercise, and immediately after the examination the papers were returned to South Kensington for inspection by the Examiners of the Department of Science and Art. Of the 164 Students examined, 112 (61 males and 51 females) were successful in 164 papers. Two Students executed the whole of the four subjects required in order to obtain the full certificate, viz.—Henry Jesson and Nannie Robinson; and eight others completed the papers necessary for the same distinction.

The following Table shows the result of the Local Examination of the School in the above-named subjects for the years 1861 to 1868, both inclusive:—

	Number of Students successful.	Number of Papers passed.	Number of Prizes.
1861	20	22	5
1862	32	45	16
1863	23	30	12
1864	42	63	37
1865	72	115	70

In 1866 the new regulations came into force, consequent upon the recommendation of the Select Committee of the House of Commons, by which the standard of these Examinations and of works generally for competition was raised; fewer prizes and certificates being awarded than formerly, and Local Medals and National Medallions were discontinued.

The Local Medals awarded previously to 1866 are now represented by the present third or highest grade prizes, consisting of books, whilst the National Medallions are represented by the Queen's Prizes, also consisting of Books.

National Medals were for the first time offered by the Department in 1866, and they are the highest awards ever held out to Students of Schools of Art—the total number competed for by all the Schools being 60.

Results of local examination subsequent to new regulation:—

	Number of Students successful.	Number of Papers passed.	Number of Prizes.
1866	52	80	27
1867	67	98	28
1868	112	164	50

The works of the Students of this School in most of the stages of Art Instruction were transmitted to London on the 9th of April last, as follows:—

Number of Works in advanced stages,	118
,, ,, in Elementary do.,	81
Total,	199
Supplementary Works, or ordinary class exercises,	230
Gross total,	429

The above 429 works were executed by 173 Students.

64 of the advanced works mentioned above were selected to enter into the National Competition, along with works similarly selected from the other Schools of the United Kingdom.

The annexed Table shows the result of this Competition for the past six years:—

	Number of Works selected for National Competition.	Number of National Awards.
1863	3	1
1864	10	4
1865	29	4

	No. of Works forwarded.	No. of Works selected for National Competition.	No. of National Awards.
1866	113	41	8
1867	156	48	9
1868	199	64	11

The appended Table shows the position occupied by the Dublin School, as compared with the other most important Art Schools of Great Britain in the National Competition of 1868 :—

	Number of National Awards.
South Kensington, Male School,	10
" " Female School,	7
Dublin,	11
Edinburgh Male School,	7
" Female School,	2
Manchester,	7
Birmingham,	5
Glasgow,	3
Leeds,	1
Lambeth,	5
Liverpool,	0

The total number of Art Schools is about 100, and 31 received National Medal awards in this year's competition—29 in 1867, and 31 in 1866.

The names of the Students of the Dublin School awarded in the National Competition are as follows :—

Miss Frances Brett,	*Gold Medal and Princess of Wales's Scholarship.*
Mr. William H. Murray,	*Silver Medal.*
Miss Ruth E. Nicholson,	*Ditto.*
Miss Marcella Irwin,	*Ditto.*
Mr. William Millard,	*Bronze Medal.*
Miss Frances Seymour,	*Ditto.*
Mr. James M'Donald,	*Queen's Prize.*
Mr. Thomas Spring,	*Ditto.*
Mr. Michael Fitzgerald,	*Ditto.*
Mr. Edmond R. Byrne,	*Ditto.*

The following is a copy of the remarks made by the Examiners of the Department of Science and Art at the inspection of the works submitted by this School :—

"Dublin exhibits a very large number of works in almost every branch of the Art Curriculum, and it is gratifying to be able to testify to the general excellence of the acquirement in this School.

"The studies from the antique were, in some instances, of considerable merit, whilst that desirable practice of drawing from extremities was pursued with advantage to the Student.

"There were not many Paintings from groups of Still Life, but those few showed the result of sound and careful instruction.

"The Paintings from Life in Oil were also very creditable, and the Landscape Painting in the same material, and in Water Colour, evinced much ability.

"About thirty designs for Poplins and Muslins (the staple manufacture of the city) gave evidence of the mode in which the training of the Students has been directed to a legitimate object, and many were skilfully treated.

"Shaded Drawings from models were numerous and well carried out, and the studies of Ornament, both from the round and the flat, though not large in number, gave sufficient promise of future progress."

The Examiners of the National Competition works were, Daniel Maclise, R. A.;

J. C. Horsley, R. A.; Richard Westmacott, R. A.; Frederick Leighton, R. A.; M. Digby Wyatt; Richard Redgrave, R. A.; H. A. Bowler, Official Inspector.

Of 39 Bonuses offered to Head Masters of Schools of Art for successful management, a Second has been awarded to Mr. Lyne, the Head Master of the Schools of this Society.

To those works not entering into the National Competition, 16 third or highest grade prizes (corresponding to "Local Medals" awarded previous to 1866), and one Honourable Mention were gained, in addition to which, 47 other works were considered as satisfactory by the Examiners.

Three Free Studentships were obtained by Marcella Irwin, Elizabeth Irwin, and Kate O'Brien.

One Student of the School, Sarah Barry, passed a successful examination in London, for the first Certificate of the highest grade, and gained a National Scholarship in the South Kensington Schools.

The adjudication of the Medals offered by the Royal Dublin Society took place on the 19th December, by the following Judges, viz.:—Sir George Hodson, Bart.; General Colomb, and Thomas A. Jones, Esq.

133 Works were submitted in the following subjects, viz., Painting from the Life, Drawing from the Antique, Anatomy, Landscape from Nature, Modelling from the Life, and Antique, Designs for Manufactures, Architectural and Mechanical Drawing, Practical Geometry, Perspective, Orthographic Projection, and Models shaded in Chalk.

9 Medals in addition to those offered by the Society were recommended by the Judges.

The Worshipful Company of Plasterers of London have offered four Money Prizes to be competed for by Students of Schools of Art, and it is to be hoped that other Companies, and the great Manufacturers of our own country, may see the value and advantage likely to accrue from proposing similar Prizes for Designs in other departments of Ornamental Art.

Prizes offered by the Plasterers' Company.

For an Original Design, shaded in relief, either in Chalk or Monochrome, for an Over-door capable of being produced in Plaster.

For the best, ...	£7	7	0
For the second best, ...	4	0	0

For a Model in Plaster of an ornamented truss or bracket suitable for supporting a beam or a bust.

For the best, ...	£8	8	0
For the second best, ...	5	5	0

The Committee desire, in concluding their Report, to express their approbation of the zeal, efficiency, and ability of the Head Master, Mr. Edwin Lyne, and of the Art Mistress, Miss Julyan, who have afforded them the greatest satisfaction; and from the efforts of the former the School of the Royal Dublin Society has obtained the Second Place in the United Kingdom.

Of the other teachers the Committee desire to make honorable mention; they have used their utmost exertions to carry out the system which has been happily established in the Schools.

An exhibition of the Students' works, which for number and excellence was never before equalled, took place in the School of Art during the Christmas vacation, and was visited by 3421 persons.

(Signed) J. S. Adamson, Lieut.-Colonel, *Chairman.*

REPORT

OF THE JUDGES OF THE WORKS EXECUTED IN COMPETITION FOR THE SOCIETY'S PRIZES.

In reporting the result of our examination of the Works of Students in the Schools of Art, we are concerned to find, that upon this occasion the competition in a few of the sections is somewhat limited, more particularly as regards studies of a Head in Oil, and of Landscapes from Nature.

In the other sections, however, we have been much gratified by the marked excellence displayed in the Works submitted, many of them manifesting a very considerable degree of attention to correct design and patient study.

We are especially pleased with the talent displayed by several of the Pupils in the department of Design as connected with Manufactures; and feeling that most valuable results may be expected to follow encouragement in this important department, we have ventured to recommend supplementing the Prizes offered for Designs for Tapestry, Muslins, Pottery, and Porcelain, many of the works in competition bearing evidence of very tasteful arrangement in design and harmony of colour.

The following are our awards:—

Sec.		
1.	Prize withheld.	
2.	Miss Clara Bayly—Antique (Figure), ...	*Bronze Medal.*
	And we recommend a Special Silver Medal to be awarded to Mr. Michael Fitzgerald, he being a Pupil Teacher; we also think the Studies from the Antique of Mr. Robert Walshe, Pupil Teacher, and of Miss Anna Parnell, deserving of favourable mention.	
3.	No competition—Time Drawing.'	
4.	Mr. Edward Gibson—Antique (Extremities of Figure), .	*Second Silver Medal.*
	Miss Elizabeth Bredin, Do., ...	*Bronze Medal.*
5.	Miss Amelia Parkinson—Anatomy, ...	*Second Silver Medal.*
6.	Mr. Edward Gibson—Landscape (Nature), ...	*First Silver Medal.*
7.	Mr. William Millard, for his Model in Clay from the Life, on the understanding that a similar distinction was taken by him last year, for his Model from the Antique, .	*First Silver Medal.*
8.	Mr. Robert Smith—Modelling (Antique), ...	*Second Silver Medal.*
	Miss Kate O'Brien, Do. Do.	*Bronze Medal.*
9.	Miss Ruth Nicholson—Design (Original), ...	*First Silver Medal.*
	Miss Frances Jordan, Do., Do., ...	*First Silver Medal.*
	Mr. Francis Spring, Do., Do., ...	*First Silver Medal.*
	Miss Minnie Mahony, Do. Do., ...	*Second Silver Medal.*
10.	Mr. Silvester Reilly—Architecture, from Measurement, .	*First Silver Medal.*
	Mr. Albert Edward Murray, Do.	*Second Silver Medal.*
11.	Mr. James Lynch—Machine Drawing, from Measurement,	*Second Silver Medal.*
	Mr. Walter Hope Campbell, Do., ...	*Bronze Medal.*
12.	Mr. Richard Dowling—Geometry, ...	*First Bronze Medal.*
	Mr. Thomas Tatton, Do., ...	*Second Bronze Medal.*
13.	Mr. Silvester Reilly—Perspective, ...	*First Bronze Medal.*
	Mr. Joseph Johnson, Do., ...	*Second Bronze Medal.*
14.	Miss Amelia Parkinson—Model Drawing, ...	*First Bronze Medal.*
	Mr. Francis Thompson, Do., ...	*Second Bronze Medal.*
15.	Mr. Silvester Reilly—Projection, ...	*First Bronze Medal.*
	Mr. Anthony Scott, Do., ...	*Second Bronze Medal.*

GEORGE HODSON, BART.
THOMAS A. JONES, R. H. A.
GEORGE COLOMB, *Lieut.-General.*

December 19th, 1868.

PRIZES

AWARDED BY THE DEPARTMENT OF SCIENCE AND ART.

NATIONAL GOLD MEDAL.

Brett, Frances,	*Design for Wall Decoration.*

NATIONAL SILVER MEDALS.

Irwin, Marcella,	*Design for a Carpet.*
Murray, William H.,	*Design for Wall Decoration.*
Nicholson, Ruth E.,	*Design for Muslin.*

NATIONAL BRONZE MEDALS.

Millard, William,	*Head modelled from Life.*
Seymour, Frances,	*Group in Oil.*

QUEEN'S PRIZES.

Byrne, Edmond R.,	*Drawing from the Antique.*
Fitzgerald, Michael,	*Drawing from the Life.*[*]
Macdonnell, James,	*Group in Oil.*
Spring, Francis,	*Design for Furniture Poplin.*

SELECTIONS FOR NATIONAL COMPETITION.

	Subject.
Aitken, James,	*Painting of Landscape in Oil Colour from Nature (2 Works).*
Bayly, Clara,	*Painting in Oil the Human Figure from Nature.* *Shading in Chalk of the Human Figure from the Round (Antique).*
Brett, Frances,	*Applied Surface Design (3 Works).*
Byrne, Edmond R.,	*Painting of Landscape in Oil from Nature.* *Shading in Chalk of the Human Figure from the Round (Antique), 2 Works.*
Fitzgerald, Michael,	*Shading in Chalk of Head, Hand, and Feet from Casts (2 Works).* *Shading in Chalk of the Human Figure from the Life.* *Painting of Landscape in Oil from Nature (3 Works).*
Hamilton, Henrietta,	*Applied Surface Design.*
Hamilton, Lucy,	*Painting Flowers in Water Colours from Nature (2 Works).*
Irwin, Elizabeth,	*Anatomical Studies of the Human Figure.* *Applied Surface Design.*
Irwin, Marcella,	*Painting in Monochrome of Ornament from the Cast.* *Applied Surface Design.*
Jennings, Elizabeth,	*Shading in Chalk of the Human Figure from the Round (Antique).*
Jordan, Frances,	*Applied Surface Design.*
Mahony, Minnie,	*Do., Do. (4 Works).*
Marquiss, Margaret,	*Painting of Landscape in Oil from Nature.*
Millard, William,	*Shading in Chalk of the Human Figure from the Round (Antique).* *Modelling the Human Figure from Nature.*
M'Dermott, Madeline,	*Shading in Chalk of Head, Hands, and Feet, from Casts.*

---

[*] This work was executed at the Royal Hibernian Academy.

Macdonnell, James,	*Painting Groups in Oil as Compositions of Colour.* *Painting Landscape in Oil from Nature* (3 *Works*).
Murray, William H.,	*Applied Surface Design* (2 *works*).
Nicholson, Ruth E.,	*Do., Do.* (*Muslins.*)
O'Brien, Kate,	*Modelling the Human Figure from the Round* (*Antique*).
Smith, Stephen Catterson,	*Shading in Chalk the Human Figure from the Round* (*Antique*). *Painting in Oil the Human Figure from Nature.*
Smyth, Thomas,	*Shading in Chalk of Ornament from the Round.*
Spring, Francis,	*Applied Surface Design* (*Tabinet*).
Walker, Francis,	*Painting in Oil of the Human Figure from Nature.*
Walsh, F. Robert,	*Shading in Chalk of the Human Figure from the Round* (*Antique*). *Painting in Oil of Landscape from Nature.*
Wallace, Elizabeth,*	*Painting Flowers in Water Colours from Nature* (3 *Works*).
Bergin, Isabella,	*Applied Surface Design.*
Booth, Matilda,	*Do., Do.*
Gibson, Edward,	*Shading in Chalk of Head, Hands, and Feet, from Casts.*
Lynch, James,	*Drawing of Historic Styles of Ornament.*
Seymour, Frances,	*Painting in Water Colours of Flowers from Nature.* *Painting Groups in Oil as Compositions of Colour.* *Applied Surface Design.*
Seymour, Kate,	*Painting in Water Colours from Nature.* *Painting in Oil of the Human Figure from Nature* (2 *Works*). *Painting in Oil Group as composition of colour.* *Applied Surface Design* (2 *works*).†
Smith, Elizabeth,	*Painting in Oil of the Human Figure from Nature.*

THIRD OR HIGHEST GRADE PRIZES.

Barry, Sarah,	*Freehand Outline of the Human Figure from the Flat.*
Bayly, Clara,	*Freehand Outline of Ornament from the Round.*
Benson, S. Ismena,	*Group of Models in Chalk.*
Boxwell, Susan,	*Shading in Chalk of Models from the Round.*
Burton, Frederick William,	*Freehand Outline of Ornament from the Round.*
Burton, Isabella,	*Shading in Chalk of Ornament from the Round.*
Davis, Susan,	*Freehand Outline of the Human Figure from the Flat.*

---

* At a Competition invited by the Minute of Council on Education, offering Prizes for Designs for Fans, this Student obtained an Honorable Mention.

† One of these, a Design for a Carpet, has been manufactured by Mr. Peter Sheridan, of this city.

Heerwart, Eleonore,	*Freehand Outline of Ornament from the Flat.*
Lawlor, Mary C.,	*Shading in Chalk of Models from the Round.*
M'Comb, Maria,	*Freehand Outline of Ornament from the Flat.*
Parkinson, Amelia,	*Freehand Outline of Ornament from the Round.*
Mahon, Julie,	*Do. Do.*
Saunderson, Henry E.,	*Shading in Chalk of Models from the Round; Shading in Chalk of Ornament from the Round.*
Smyth, Emilie,	*Freehand Outline of Ornament from the Flat.*
Smyth, Thomas,	*Shading in Chalk of Ornament from the Round.*

HONOURABLE MENTION.

Abbott, Mary,	*Freehand Outline of Ornament from the Flat.*

FULL CERTIFICATES (SECOND GRADE).

Bergin, Isabella C.
Brett, Frances M.
Burton, Emily M.
Fitzgerald, Michael.
Jesson, Henry.
Lauder, James Stack.
Mac Sorley, Minnie.
Parnell, Anna.
Robinson, Nannie.
Stringer, Thomas.

SECOND GRADE PRIZES.

Bagot, Amy,	*Freehand.*
Bashford, Charles,	*Geometry.*
Benson, Ismena,	*Geometry and Perspective.*
Bermingham, Christopher,	*Geometry.*
Boyle, James F.,	*Freehand.*
Campbell, Colin G.,	*Do.*
Cox, Lizzie,	*Geometry.*
Cruise, Richard,	*Model.*
Donohoe, Charles,	*Freehand.*
Dowling, Richard,	*Do.*
Fitzgerald, Michael,	*Perspective.*
Grace, Annie,	*Freehand.*
Heerwart, Eleonore,	*Freehand and Model.*
Higgins, Patrick J.,	*Freehand.*
Jesson, Henry,	*Freehand and Perspective.*
Kelly, John,	*Perspective.*
Knox, Henrietta,	*Do.*
Lawlor, Mary C.,	*Geometry and Model.*
Lauder, James Stack,	*Geometry and Perspective.*
Longford, Edmund,	*Perspective.*
Mac Sorley, Katherine,	*Do.*
Magee, Mary A.,	*Do.*
Manning, John R.,	*Freehand.*
Miller, William,	*Perspective.*
Murray, Albert Edward,	*Freehand.*
O'Brien, Kate,	*Do.*
O'Neill, James Joseph,	*Geometry.*
Parnell, Anna M.,	*Freehand and Geometry.*
Pigott, Matthias,	*Geometry.*
Reigh, John,	*Freehand.*
Reilly, Sylvester,	*Perspective.*
Robinson, Nannie,	*Freehand, Geometry, and Model.*
Smith, Robert Sidney,	*Geometry.*
Smyth, Thomas,	*Geometry and Perspective.*
Todd, Elizabeth,	*Freehand.*
Wallace, Elizabeth,	*Perspective.*

Webb, John,	*Freehand and Model.*
Whelan, John Peter,	*Model.*
Williams, Alexander,	*Freehand and Model.*

SECOND GRADE CERTIFICATES.

Alston, James B.,	*Freehand.*
Armstrong, Lillie,	*Do.*
Bagot, Amy,	*Model.*
Ball, Susan,	*Do.*
Beardwood, Joseph,	*Geometry.*
Bergin, Isabella C.,	*Freehand and Model.*
Bermingham, Christopher,	*Freehand.*
Boulger, Sophia N.,	*Do.*
Boyle, James F.,	*Model.*
Brett, Frances M.,	*Geometry and Perspective.*
Burton, Emily M.,	*Model.*
Conan, Jeanie,	*Freehand.*
Cooper, Everina J.,	*Do.*
Cooper, Florence A.,	*Perspective.*
Coppinger, John,	*Do.*
Cox, Lizzie,	*Freehand.*
Corbett, Philip,	*Do.*
Crooke, William,	*Freehand and Model.*
D'Arcy, Henrietta T.,	*Model.*
Davis, Mary Hastings,	*Perspective.*
Davis, William K.,	*Do.*
Finigan, James B.,	*Freehand.*
Fitzpatrick, Katie,	*Freehand and Model.*
Furniss, Henry,	*Freehand.*
Gerrard, Elizabeth,	*Geometry and Perspective.*
Gerrard, Roberta S.,	*Freehand.*
Goodwin, Emma H.,	*Do.*
Gregg, Sarah J.,	*Model.*
Gunn, Christopher.,	*Freehand and Geometry.*
Hamilton, Lucy,	*Mechanical.*
Hanly, Sarah J.,	*Freehand.*
Hanly, Sharland,	*Do.*
Harris, Fannie,	*Geometry.*
Harvie, Elizabeth,	*Freehand.*
Hume, Charles T.,	*Freehand in Geometry.*
Jesson, Henry,	*Geometry and Model.*
Johnston, Joseph,	*Perspective.*
Johnston, Malcolm M.,	*Freehand.*
Kerrigan, Joseph,	*Do.*
Kenny, Richard Thomas,	*Do.*
Kenny, Robert H.,	*Do.*
Knox, Henrietta,	*Freehand and Model.*
M'Dermott, Madeline,	*Geometry.*
Mac Sorley, Minnie,	*Perspective and Model.*
Manning, Hubert,	*Freehand.*
Manning, John R.,	*Geometry.*
Marshall, John,	*Freehand and Model.*
Middleton, David,	*Do.*
Millard, Joseph J.,	*Model.*
Mitchell, James,	*Freehand and Model.*
Moran, Mathew H.,	*Model.*
Moss, Amelia J.,	*Freehand.*
Moss, Annie,	*Freehand and Model.*
Moss, Mary T.,	*Freehand.*
Moulang, Thomas H.,	*Do.*
Murphy, Mary F.	*Do.*
Newton, Emily,	*Do.*
O'Hanlon, Amelia,	*Do.*

O'Hanlon, Julie,	*Freehand and Perspective.*
Parkenson, Amelia,	*Perspective and Model.*
Parnell, Anna,	*Perspective.*
Parnell Fannie,	*Freehand and Model.*
Parnell, Theodocia,	*Freehand.*
Payne, Benjamin H.,	*Freehand and Model.*
Phillips, Isaac,	*Freehand and Geometry.*
Proctor, Thomas C.,	*Freehand and Mechanical.*
Reede, Linda G.,	*Model.*
Reilly, Sylvester,	*Mechanical.*
Robinson, Nannie,	*Perspective.*
Sibthorpe, Henry J.,	*Freehand and Model.*
Smith, Charles C.,	*Freehand, Geometry, and Model.*
Smith, Robert John,	*Freehand.*
Smith, Robert Sidney,	*Model.*
Smyth, Elizabeth M.,	*Freehand and Model.*
Smyth, Emily M.,	*Freehand and Geometry.*
Smyth, Francis,	*Freehand.*
Spencer, William,	*Do.*
Stewart, Thomas Kirk,	*Do.*
Stringer, Thomas.	*Perspective.*
Thompson, Francis C.,	*Model.*
Todd, Elizabeth,	*Geometry.*
Wallace, Elizabeth,	*Freehand and Model.*
Webb, Graham,	*Freehand.*
Whelan, John Peter,	*Do.*
Wilkins, William,	*Do.*
Woodhouse, Clara C.,	*Freehand and Perspective.*
Woods, Lydia M.,	*Freehand.*

PRINCESS OF WALES SCHOLARSHIPS.

Two Scholarships under the above title have been founded for the two Students who, being females, take the highest Prize of the year in the National Competition of all the Schools of Art in the United Kingdom.

One of these Scholarships has this year been awarded to Miss Francis Brett, of the Royal Dublin Society's School of Art.

(Signed) EDWIN LYNE, *Head Master.*

The Students named in the foregoing Reports were each presented to his Excellency the President, who presented the Prizes to them.

The EARL of CLANCARTY, on the part of the Royal Dublin Society, moved a vote of thanks to His Excellency for distributing the prizes, and to the Countess Spencer for honouring the meeting with her presence.

The Right Honorable the LORD MAYOR having seconded the resolution,

His EXCELLENCY then said—My Lord Clancarty, my lords and gentlemen, I thank you most heartily for the welcome which you have given me here to-night as the representative of our gracious Queen. I thank you also on the part of Lady Spencer for the compliment you paid her in coupling her name with mine in the resolution which has been put before you. I know I can say that it is with great pleasure she has come here to-night to witness the interesting ceremony at which I commence my career as President of the Royal Dublin Society. Ladies and gentlemen, the Royal Dublin Society has a vast field for its operations. The Secretary, Mr. Maunsell, who opened the proceedings, alluded to some of the objects which the Society has in view to promote. When the time comes I hope I may not be wanting, as an agriculturist in England, and one who feels deeply the importance of promoting the development of agriculture in this country, in coming forward and endeavouring to show what England can do in the way of cattle, to compete with the well-known herds of Ireland. It is not, perhaps, proper for me in this assembly, where I see so many ladies, to allude further to agricultural pursuits, or to the increase and bettering of the breed of cattle in the United Kingdom. Nor must I allude at any length to another topic, on which I confess I feel deep interest, and that is the production of horses which will carry not only their riders with safety over a difficult country, such as we know exists in Ireland, but which will also improve the breed of useful animals for the benefit of the people. I would rather confine myself to the topics which are more proper for the discussion and consideration of this assembly—topics which relate to art and science, which also come within the wide and important range of the operations of the Royal Dublin Society. The president of the Art Department of this Society has alluded to the various changes that have taken place in the connexion between this Society and the Government of the United Kingdom. I may, perhaps, be expected to allude to these topics to-night, but I do not think it would be wise for me to enter at length into them, not because I have not already some opinions formed on the important subject, but because I know within a few days an important Report will be laid before her Majesty's Government from the Royal Commission appointed to report on the position of the various scientific and art institutions connected with Ireland. I therefore do not think it would be proper for me to dwell on that question now. It is a matter of great satisfaction to hear the Report which has been read by your chairman to-night—a Report from the Committee of Science and Art in London on the position of these important institutions in Ireland. It is satisfactory to hear that a large number of the students who studied under the auspices of the Society have been successful in the national competitions which have taken place under the auspices of the Science and Art Department in England. It is satisfactory to learn not only that the teachers here have attained great excellence—and in reference to that I wish to call particular attention to the fact that the head master, Mr. Edwin Lyne, belonging to this Society, has, I believe, gained the second prize amongst the teachers of all England, for the success of his teaching—and also that you have been very successful in the designs connected with the staple manufactures of Ireland. There can hardly be a more important object that this Society has in view than the improvement of the designs connected with the manufactures of the country. I may congratulate this Society on taking so high a place amongst other societies of the United Kingdom. It is a matter of great congratulation that the pupils who went up from this country should be second to only one school in the United Kingdom, that school being the central school, the school of South Kensington. And I may say, without drawing any invidious comparison, that the pupils who live within reach of that important and admirable museum have very great advantages. I may, I hope, be allowed to congratulate one person very specially to night, and that is one of those ladies to whom I have had the pleasure of presenting a prize—Miss Brett. I may congratulate Miss Brett not only in having secured a gold medal in one of the national competitions, but in having become one of the scholars known by the name of the Princess of Wales' Scholars. I congratulate Miss Brett, not only on the honour she has attained for herself, but for the honour she has attained for this, her native town and city. May Miss Brett long look as an example to the lovely form of her with whose name her honours are so justly connected. May she look to the Princess of Wales as to one whom not only nature and Providence have adorned with all the charms, the winning charms, intrusted now and then to mortals to do good in this world, but also to one who, by her simplicity and unaffected nature, seems to be unaware of the wonderful power she can exert. I do not feel, ladies and gentlemen, that I have any right to enter largely on the subject of art, but I feel bound to make one or two observations, and I make them with some diffidence. I think it is very often not appreciated how great a power art has in the history of a country; I mean, in recording the deeds of our countrymen, and the noble deeds which they achieve for the benefit of their country. Now, I believe that art, particularly the art of painting and the art of sculpture, take a very great part in educating one generation as to the deeds of another. Many have not time to read long writings and history, but they may possibly see the works of painters or the works of sculptors. Many others are familiar with the death of Wolfe through the fine painting which we know came from the hand of West. We are reminded of Trafalgar by the noble work of Stansfield. Our warriors, our statesmen, our painters, our soldiers, are recalled to us through the canvas of Holbein, Vandyke, Kneller, Reynolds, Gainsborough, and through the chisel of Chantrey. We are able by this means to people the halls and galleries of old England, and the assemblies and churches of our country, with images, probably not at all unlike those who really figured in old days in our country, and whose works we now derive benefit from and advice. It is a noble work for those who are educating the people in art—it is a noble work to teach men to be able with power and effect to immortalize the deeds and trace the features of those who are living in this country. Now I believe that in Great Britain at this time we have made very great strides towards the improvement of the fine arts, and I believe, I may say, that the part which this country has to play in promoting the fine arts of Great Britain is by no means a small one; for I believe it belongs to the character of this people to be eminently artistic. I believe there are qualities belonging to the Irish people which are essentially propitious to the development of high art. We have the imagination which is so well known to exist amongst your people—we have that warm-heartedness, without which true art cannot be maintained, for without it you have not the proper sympathy with all the different relations of life. You have also I believe love of the beautiful very strongly developed amongst your people. It is then a noble work which I feel sure this Society will worthily carry out—that of developing the artistic feeling amongst the Irish people. And I might allude to one other function of great importance to societies like this. If we think of the position of art, we shall find that the atmosphere which it breathes is far different from the atmosphere art breathed in former days. In former days the art of Rome and Greece was encouraged by the statesmen of those countries. The great monuments and the statues that have come over from Greece and Rome were almost all designed under the guidance of men of the best taste, and they are monuments of the greatness of these countries. In mediæval times, the religious feelings of the people encouraged art, and almost all the pictures of Raphael in those days—I will not say quite all—but the majority of the pictures in the middle ages, were devoted to the encouragement of religion and the purposes of religious ceremony; but later, the great nobles and men of riches, educated by all the taste and all the experience which former ages had brought together in galleries, guided the art of these countries; but in the present day art has been democratized, if I may use the word. Painters have to go into the public market for people to patronize them. I confess, though there may be some drawbacks to that, yet I believe the artistical feeling of Great Britain will be very much improved by it. I hail this with great satisfaction, for I believe vigour and energy, and a national character, will be imparted to the art of this country. While vigour and nationality may be imparted to the artistic feelings of the country, I believe also that art will impart to the country elevated taste and great enlightenment. It is then the duty of societies like this to cultivate properly a taste amongst all classes of the country. Let them not try to pander to the public taste; let them not be led into pandering to mawkish sentimentality—a sensational excitement. That, perhaps, may be the tendency of a state of things such as I have described, but let them try to immortalize the great deeds that have been done, and may yet be done, in this country, and then they will do a great work worthy of Ireland. They can do what, I think, an American poet has said can be done by men. I think you will all, probably, remember the lines:—

> "Lives of great men all remind us
> We may make our lives sublime,
> And, departing, leave behind us
> Footprints on the sands of time."

Let your art give the noble representation of the footprints of men who have performed deeds worthy of their country. Let their works not be confined to what catches the popular taste of the moment; cultivate only that which is sublime. I will not occupy your time longer. I fear I have occupied you already too long. I would wish to see that taste for the fine arts permeate the whole country. A taste for the fine arts, in other words, is a taste for what is correct for the improvement of good taste throughout the country. In old times in Italy nearly everything that was used in life was remarkable for some beauty either of form or of colour. Why should not this be in our days? Why should we not cultivate taste in such a way that everything about us, whether our house, our carriages, our furniture, our crockery, our dress even—why should not all that be governed by excellence of taste? And if we, who are in the position of having wealth, and of being able to bestow it for the purpose of encouraging and developing art—if we assist to further good taste, we do not know what pleasure we thereby may be giving to the humbler classes of the country. One other observation I would wish to make, and it is this: that while I wish to promote technical education, which I consider to be of immense importance to the development of the manufactures of the country, I think before all it is necessary that the primary education of the people, whether rich or poor, should be extended more than it is at the present day. Without a good primary education throughout the country, I feel sure that the efforts to promote technical education and higher education in art will not be of much value. Ladies and gentlemen, I hope that in this country, as well as in the rest of the United Kingdom, those objects which I have alluded to will be promoted. And I feel sure that this Society, which has for its aim the advancement of so many useful arts, will continue to exert itself for the excellent and important objects which it has before it; and I may assure you that so long as I remain here in the position of the representative of her most gracious Majesty, I shall not fail in my efforts, whatever their direction may be, to promote the objects of your Society.

The proceedings then terminated.

ANNUAL SPRING CATTLE SHOW, APRIL 14TH, 1869.

THE EVENING MEETING.

THE usual meeting of the Society for the announcement of the Prizes awarded at the Annual Spring Cattle Show, was held on Wednesday Evening in the Lecture Theatre.

His Excellency the Lord Lieutenant arrived shortly after nine o'clock, and was conducted by the officials of the Society to the chair.

GEORGE WOODS MAUNSELL, A.M., D.L., one of the Secretaries of the Society, having welcomed his Excellency in the name of that body, glanced at the leading features of the Show. He was rejoiced that his Excellency had shown his personal interest in the exhibition by becoming a competitor, and although his Excellency had not been successful, the animals he sent in upheld the renown which belonged to the herds of Althorp. He trusted that on the next occasion his Excellency would be a prize winner, and that it would be his lot to return thanks for the successful competitors. It was often asked, what was the object of exhibiting these cattle? The answer was, to show the animals which arrived at the earliest maturity with the meat in the best condition, and thus point out to the farmers of the country the class from which they should breed. The Society was one which his Excellency would rarely meet in Ireland—it was a society without politics. It sought to improve the condition of the farmer and the labourer, without knowing anything of the schemes of land tenure put forward in different quarters.

DR. STEELE, the Registrar, read the abstract of the Prize List.

MR. WADE, Chairman of the Agricultural Committee, proposed a vote of thanks to the judges.

MR. CANNON seconded the resolution, which was adopted.

MR. ARCHDALL returned thanks for the judges.

LORD TALBOT DE MALAHIDE moved a vote of thanks to his Excellency. The predecessor of his Excellency was an Irishman, and an excellent specimen of a resident nobleman, and as such he had great advantages from his knowledge of the country. But he was quite sure that in having as that Viceroy's successor a nobleman of the exalted position of his Excellency in England, of his experience in a country life, and of his pure good sense, that they had obtained a most valuable acquisition. He would make a few remarks on the state of agriculture in Ireland, which he trusted would be taken in good part; for nothing was further from his intention than to introduce any topic connected with party or party warfare. He (Lord Talbot) should enter his protest against the production of animals of a class that staggered under the weight of an accumulation of fat. His lordship, having spoken of what had been done in this country by the landed proprietors for the improvement of stock, and having shown the value he attached to the work done by local farming societies, said that with regard to the agricultural state of Ireland, he believed all the classes connected with agriculture were prosperous. The peasantry of Ireland were never better fed or better clothed than they were at present; but at the same time he was afraid he should deceive his Excellency if he did not tell him that he feared this state of things was not likely to last. There were serious difficulties which it would be for the wisdom of whatever government that ruled this land to notice. There was a want of confidence on the part of many, while vague promises had been made which led the peasantry of the country to have exaggerated expectations, and which could not be fulfilled if the slightest regard were paid to the interests of property. Men of property in Ireland felt that they were living in troublesome times, and they were paralyzed in their efforts to improve the condition of their tenants.

THE RIGHT HON. THE LORD MAYOR seconded the motion, which was adopted by acclamation.

HIS EXCELLENCY THE LORD LIEUTENANT, who rose amidst applause, said—My Lord Talbot, my Lord Mayor and Gentlemen, I thank you most sincerely for the cordial manner in which you have received the motion which was made by Lord Talbot and seconded by the Lord Mayor. I feel that I occupy a place which has on previous occasions been filled more worthily. I know full well the popularity of my immediate predecessor, the Duke of Abercorn. Not only do I know him as a personal friend, and like him as such, but I know that he had an advantage over me—that he was, as Lord Talbot said, a resident proprietor in this country, and, I believe, an excellent landlord, before he succeeded to the office which I now have the honour of holding. At the same time, gentlemen, I feel a deep interest in the agricultural as well as in the other classes in this country, and I feel a deep interest in the proceedings here on this occasion. It is under auspicious circumstances that I have made my first acquaintance with this important Show; for I had the honour of bringing to the Show his Royal Highness Prince Arthur. The Prince's visit to this country shows the great interest which her Majesty feels in the people of Ireland. I know, moreover, that all those who have seen Prince Arthur will like him more and more, and will appreciate his high character and intelligence. And I know that his Royal Highness deeply feels the cordial welcome which he has received from the Irish people, and that he will long remember it. His visit here made a most favourable impression on him. It is, therefore, I repeat, under very pleasant auspices that I first made my acquaintance with this important Show. Important I feel it is; for I believe that in the United Kingdom there is scarcely any more influential agricultural meeting. I have not lately had an opportunity in England of seeing one of similar character; but I have been at many shows of stock in England, and I must say that I have rarely seen such a fine collection as I have seen in the yards here during the last few days. I need hardly point out the great advantage that accrues to all those who have stock or anything connected with agricultural pursuits by bringing what they have to public competition. At home we have our prejudices about our favourites and our hobbies, but when we bring our stock face to face with all the best of the same class in the country, our prejudices are soon dispelled, if not founded on a correct basis. I could hardly have expected to have been successful here to-day. I was challenged by the Honorary Secretary when I last had the honour of occupying this chair, and perhaps I was rather rash when I accepted that challenge and undertook to exhibit stock. I can hardly say that I regret having accepted the challenge, although I am rather afraid that my stock exhibited a poor figure when brought into competition with what I saw in the yard; yet I hope that in some respects they did no dishonour to a name once high in the short-horn world in England. I will not allude to politics, but I will say that if Mr. Disraeli had vacated office a few months before he did, my stock would have had a little more preparation, and I might possibly have been successful. I will not, however, be discouraged, and I hope in the autumn to have another try against Irish breeders. Without saying anything of cattle, I hope to be able to show an English horse, and I really think that in that case I shall not so easily be defeated. It is a remarkable thing to see so large a number of one class of stock brought together—I mean young stock in bulls. You had 124 animals of this class in the yard, almost all of the highest breed of short-horns. As to encouraging the breed of stock in Ireland, I cannot conceive any better method than by bringing together at this time of the year a number of animals from all parts of Ireland, to enable the farmers of the country both to select the stock from which they are to breed their cattle, and to have before them examples of the best form to which cattle can be brought by careful breeding. I believe that to be a scheme attended with the greatest possible advantage. In regard to high bred cattle, though it has been said that those who give a very high price for cattle do a very ridiculous thing; yet I venture to say that the money thus laid out largely benefits the country. It may often fail to bring a return to those that spend it, but they have the satisfaction of feeling that by getting the best stock together they are improving the general breed of cattle. What we want to get is, as Mr. Maunsell described it, the best possible form of beast—the highest degree of excellence. We want early maturity in our cattle—we want to get the best flesh, the best meat on animals of the most compact form, and this without pampering or high feeding. I recollect well that a friend of mine in Gloucestershire told me a very few years ago that he had given a fabulous price for one or two animals. His wife, I remember, laughed while pointing out to me what she called the "Golden Calf," an animal for which he paid 500 or 600 guineas when a few months old, but, he said that all the farmers in that district came to him in order to have their stock from that animal, knowing that they could always get 10*s.* or 15*s.* more for their calves than if they were from any other breed. Now, in your show-yard, I venture to say, no one ever saw two finer animals or better specimens of short-horns than Mr. Chaloner's "Sovereign," and Mr. Cosby's "Ravenswood." They show all the form that can fairly be expected in such animals, and their quality is excellent indeed. Of the other stock, there are some remarkable specimens. I may mention one of whose success I was glad—I allude to the heifer which belongs to a tenant farmer in this country. I congratulate that gentleman—he is from the county of Carlow (Mr. James Smith), if I mistake not—at having produced so very fine an animal—an animal that was able to compete with the best of those that came from England and from different parts of this country. Another animal introduced to me—a breed but little known in England, that of the Kerries. That breed could not be represented by a neater or better looking animal than the heifer belonging to Miss Barrington, whom I heartily congratulate on her success, and who I hope may rival that distinguished exhibitor of short-horns, Lady Pigot. In this country, though there may be a difference of opinion with respect to pasturage and arable land, there can be no question as to the very great importance of obtaining the very best stock that can be procured. Now, it is satisfactory to me, who belong to a family which has always been very partial to short-horns, to see how that breed has taken root in the country—to see what an excellent and really useful breed it has proved, and how very valuable it is likely to be to the farmer in Ireland. A few years ago, when the cattle plague was raging in England, many of the great graziers in my neighbourhood—in the midland counties—got their stock from Ireland. They have a considerable number over every summer, and I know well that the only year in which my farming was at all fortunate was the year when I brought over 80 short-horned steers from Ireland. Don't suppose I got them cheap. I remember complaining very much to my bailiff that he gave too much money for those animals, but their quality was so good, and the improvement they made so great, that, as I said, the year in which I got them was almost the only fortunate year of my farming life. Now, that I believe to be an important and suggestive fact for the farmers of this country. In connexion with this, there are one or two matters that I think deserve attention—one is the great value of securing proper measures against the spread of contagion amongst the cattle of this country. When we see such valuable stock as that which fills your yards at present, we must at once be conscious of the great importance of the precautionary measures I allude to. During the cattle plague, this country, owing to the wisdom of the government, had an almost complete immunity from that distressing calamity. But, at the same time, it is well to consider—and none can consider this so well as the Royal Dublin Society—whether there cannot be improvements effected in the laws that regulate contagious disease amongst cattle. In England at this time very considerable attention is being paid to this subject. The measure introduced by government does not affect Ireland; but I think it behoves those in Ireland to look into the matter, and see whether similar regulations could not with advantage be made for this country. The health of cattle depends very much on the care of them by the owners, but still a great deal can be done by proper and well-devised rules. It is a curious fact that, after the cattle plague restrictions, which were extremely heavy and distressing to the farmers in England, had been in force for some months, there was an almost complete disappearance of some of the diseases that formerly had attracted so much attention. The lung disease and the foot disease, which all farmers know are so destructive of the health, nay, the life of stock, almost vanished after the strict regulations were put in force in England, I mention this to illustrate the importance of having proper regulations with respect to cattle in this country; and I believe the Royal Dublin Society could do very good work by advising those who are responsible in the matter. To one point I would desire to draw your particular attention—that is, the regulations that may be made with respect to the transit of cattle. It is of the highest importance that the railway trucks should be kept perfectly clean and thoroughly disinfected, and that the "lairs" (I believe that is an English term not used in Ireland,) where the cattle are kept before they are exposed in market, should also be perfectly disinfected and cleansed. Proper food and water should be given to cattle during their transit, and the steamboat where they are confined should be managed in a humane and proper way. The neglect of all those essential points does an immense deal of mischief in importing and aggravating cattle disease. I think it is of the utmost moment to a breeding country like Ireland, which exports a large number of cattle, that these matters should be looked to, and regulations made to prevent abuse and mischief. Although for the time restrictions may be irksome, yet remember, if the idea got abroad in England that you were exporting disease from this country, your cattle trade would go down very much. I am happy to be able to say, from information which I have received, that there never was a time when the cattle in this country was in a healthier condition than at present. But I think it is much better to attend to these matters while we are in that happy state, than to wait till the evils we would avoid are rife amongst us. There is one other point which I consider of great interest in connexion with live stock in Ireland. I believe there is in this country no veterinary college. Now, I certainly think it of vast importance to the owners of stock that there should be a competent and able body of men to advise them as to the health of their cattle, and not only that, but that they might be able in a moment of emergency to assist the government to investigate the causes of disease and extinguish contagion, if it should exist. There can be no doubt that there are many able veterinary surgeons in this country—many who have come from the veterinary colleges of England and Scotland; but I think it would be of great advantage if there was a veterinary college or a veterinary department under a body established in this country; for I have no doubt that many who have a desire to enter the veterinary profession, when they find that they should go across to England or Scotland for the purpose, are prevented from doing so, and a field for useful work is thus closed to many Irishmen. I have often regretted, too, that there is not more sympathy and union between the medical and the veterinary sciences. If there was more of union and sympathy the result would be mutually advantageous to both professions. The veterinary science would derive great benefit from the vast knowledge and experience of the higher profession, and, on the other hand, medical science and research would be advanced considerably by the facts learned from experiments on animals. When I had the honour of being on the Cattle Plague Commission, we carried out very extensive experiments in relation to the diseases of cattle. We had several distinguished medical gentlemen on our Commission, and with their consent many curious experiments were made in relation to disinfection—the indications of disease, the particular remedies to be applied, and the way of tracing their operation, and very important discoveries were made not only in veterinary science, but also in the treatment of human maladies. I will not—I think it would not be my place to do so—say how this institution could be obtained; but I do think that it would be a great advantage to Ireland if such an institution were established in this country. I will trespass a moment or two more to allude to the poultry and implement section of the Show. I was much interested in the poultry, which has become a useful element in the business of the small farmers and cottagers here. The number of poultry in Ireland has largely increased of late years. They have nearly doubled within the last twenty years. They now amount to over 10,000,000, and form a very substantial item in the wealth of the country. I find that in the Government Report, from which I take these numbers, they are all valued at 6*d.* a piece. I don't know that I should like to give you any secrets of my household, but I must say that, looking at this value, I pay very highly for poultry. For I find that I pay 7*s.* here in Dublin for large chickens—2*s.* 6*d.* for an ordinary, but 7*s.* for a large one. I think that with these prices for chickens the breed of poultry in this country should be encouraged; it would be the means of bringing great wealth to the farmers. I would say one word as to the importance of encouraging the use of good implements in your agriculture. Having had the opportunity, when amusing myself near Dublin, of seeing the manner in which the agriculturists of Meath and Kildare carry out their tillage, I have been very much struck at seeing that the ploughing is usually conducted on the highest principles of English agriculture, and that the ploughs used are of the latest pattern shown at the agricultural meetings in England. The use of the best ploughs is attended with the greatest economy of labour and skill, and I believe I may attribute the excellence of those that I have seen to the teaching of this Society. I noticed this day what I consider to be a most important machine—a machine for dealing with flax—which is a very important branch of the agriculture of the country. There has been a great increase within the last few years in this product. Within the last six years the number of those employed in dealing with flax in this country has risen, I think, from 20,000 to 60,000. It is a remarkable thing that of the number of hands employed in manufactures in this country, namely, 67,000, 60,000 are employed in trades connected with flax. Now, everything that encourages a manufacture so important as this, and cheapens the process of labour, must be of importance. The machine I allude to was one—I don't know that I use the correct expression—used for the dressing of flax. Gentlemen, I will now conclude. I have to thank you for the kind manner in which you listened to the remarks which I ventured to make. I most sincerely trust that the good work which this Society has already done will long be continued, and that it will tend to the prosperity and advantage of this country.

APRIL, 1868.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P.M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
1 Wednesday, . .	8	30·388	56°	30·389	60°	35°	34°	46°	48°	60°	55°	S. E.	8	. .	Very fine & mild, with bt. sun., fair at nt.
2 Thursday, . .	9	30·338	54	30·345	58	33	31	45	47	58	54	S. E.	8	. .	Very fine, bt. sunshine, frosty during night.
3 Friday, ...	10	30·144	54	30·151	57	35	33	45	47	57	54	S. E.	8	. .	Very fine, bt. sun., cold wind, frosty at night.
4 Saturday, . . .	11	30·028	49	30·048	53	43	39	45	47	53	50	S. W.	0	. .	Fine & dry, overcast, cd. at nt., ovct. & mild.
5 Sunday, . . .	12	29·950	56	29·951	60	41	38	46	47	60	55	S. W.	5	. .	Mild & fine, cloudy, bt. sunshine at times.
6 Monday, . . .	13	29·950	56	29 951	59	45	41	47	48	59	54	S. W.	6	. .	Mild & fine, cloudy, showery, fine bt. sun.
7 Tuesday, . . .	14	29·570	53	29·581	59	50	46	48	49	59	52	S. E.	0	·020	Very mild, cldy., showery, ovct. throughout.
8 Wednesday, .	15	29·644	42	29·683	58	41	40	45	47	42	42	N. E.	0	·090	Cloudy and cold, showery throughout.
9 Thursday, . .	16	30·008	42	30·047	45	37	35	43	45	45	43	N. W.	0	·010	Cldy., very cd., s. rain, stmy. wind, fine & d.
10 Friday, ...	17	30·050	46	30·078	49	31	30	42	44	49	45	N. E.	1	. .	Cloudy and cold, frosty, fine but very cold.
11 Saturday, . .	18	29·996	48	30·019	50	31	31	42	44	50	46	N. E.	1	. .	Occas. suns., frost, extry. cd. wd. throught.
12 Sunday, . . .	19	29·930	53	29·940	53	39	35	43	45	53	51	S. E.	2	. .	Very cd. wind throughout, d. and fine, cly.
13 Monday, . . .	20	30·066	54	30·073	56	41	35	45	46	56	52	S. E.	3	. .	Mild and fine, occasional sunshine, cloudy.
14 Tuesday, . . .	21	30·192	55	30·196	54	34	35	45	46	54	50	S. E.	2	. .	Fine & dry, occas. suns., frosty & cold, cldy.
15 Wednesday, .	22	30·282	50	30·299	56	36	37	45	46	56	51	S. W.	3	. .	Fine and dry, mild, cloudy, sunshine.
16 Thursday, . .	23	30·256	57	30·255	60	40	39	49	49	60	57	S. W.	4	. .	Very dry & fine, brisk wind, cloudy, suns.
17 Friday, . . .	24	30·014	52	30·026	54	49	46	48	50	54	53	N. E.	2	·020	Bright suns., very mild & fine, cldy. & shry.
18 Saturday, . .	25	29·712	52	29·725	54	40	40	48	49	54	51	S. E.	1	. .	Fine & mild, overcast & calm, occas. suns.
19 Sunday, . . .	26	29·000	50	29·019	52	45	44	47	49	52	51	S. E.	0	·060	Dull. cl. & cd., showery, occas. sun. bk. wd.
20 Monday, . . .	27	28·928	49	28·950	52	45	42	46	49	52	49	N. W.	0	·410	Cloudy & shry., fine but cd., h. rain, bk. wd.
21 Tuesday, . . .	28	29·260	55	29·267	59	47	43	47	49	59	53	S. W.	0	·050	Cldy. & shry., cd. wind, very stry., oc. sun.
22 Wednesday, . .	●	29·400	50	29·419	51	46	44	46	48	51	50	S. E.	0	·230	Cloudy & shry., fine & mild, continued rain.
23 Thursday, . .	1	29·562	53	29·573	55	45	41	46	48	55	53	S. W.	0	·430	Cont. rain, fine & mild, cloudy, shry., suns.
24 Friday, ...	2	29·578	52	29·591	55	40	40	48	49	55	53	N. E.	8	·100	Cloudy & showery, fine & mild, bright suns.
25 Saturday, . . .	3	29·996	56	29·997	59	37	36	47	49	59	54	N. W.	8	. .	Very md. & fine, frosty, bright suns., cloudy.
26 Sunday, . . .	4	29·956	48	29·979	60	40	39	47	49	60	57	N. W.	8	. .	Very bright & fine, cool & frosty, bt. suns.
27 Monday, . . .	5	29·874	46	29·903	43	40	38	46	49	43	43	N. W.	0	·230	Fine, but cold, shry., fine, cold, cont. rain.
28 Tuesday, . . .	6	29·790	51	29·806	56	39	37	45	48	56	53	N. W.	0	·070	Very cd., with shrs. of hail & rain, cl. & shy.
29 Wednesday, .	7	30·016	58	30·012	60	44	42	48	49	60	55	N. W.	5	. .	Cloudy, fine and mild, sunshine, brisk rain.
30 Thursday, . .	8	30·000	54	30·007	56	44	42	47	49	56	53	S. W.	4	. .	Bright suns., cloudy, fine & bright, but c. wd.
													82	1·720	inches.

MAY, 1868.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth.		Dry.	Wet.	Direction.			
								5 in.	10 in.						
			°		°	°	°	°	°	°	°				
1 Friday, . . .	9	30·064	60	30·054	61	50	48	50	50½	61	58	S. W.	3	·020	Cloudy & dull, shry. throughout, brisk wd.
2 Saturday, . . .	10	30·018	59	30·011	61	49	47	51	52	61	57	S. E.	4	. .	Close & dull, very mild, cl. at nt., bt. suns.
3 Sunday, . . .	11	29·928	55	29·932	58	48	46	50	52	58	53	N. W.	8	. .	Very dry & fine, cd. wd., hot. suns. thrght.
4 Monday, . . .	12	30·078	52	30·090	54	35	36	49	51	54	50	E.	9	. .	Very cl. & fine, cd. wd., fy. at nt., b. suns.
5 Tuesday, . . .	13	30·148	55	30·152	56	43	41	49	51	56	53	E.	8	. .	Very clear & fine, cold wind, bright suns.
6 Wednesday, . .	14	30·136	54	30·143	55	44	43	49	51	55	52	E.	9	. .	Bright suns., cold wind, frosty air at night.
7 Thursday, . . .	15	29·918	61	29·908	64	49	45	51	52	64	62	S. E.	8	. .	Bright suns. & very fine & md. throughout.
8 Friday, . . .	16	29·676	54	29·684	56	49	46	50	52	56	53	W.	4	·040	Bt. suns. very fine & md., st. shs. cl. & dull.
9 Saturday, . .	17	29·782	59	29·777	61	43	42	50	52	61	58	S. E.	3	. .	Very fine & md. throughout, cl. & fgy., ovct.
10 Sunday, . . .	18	29·778	60	29·695	63	44	43	52	53	60	59	N. E.	5	. .	Bright sun., very fine & md. fgy. & overcst
11 Monday, . . .	19	29·610	54	29·543	65	44	44	50	52	65	54	S. E.	2	.	Fine & mild, cold & fsty. at nt., cldy. & ovc.
12 Tuesday, . . .	20	29·760	62	29·672	64	47	45	51	53	64	60	S. W.	4	·020	Fine & mild, bright suns., showery, ovcst.
13 Wednesday, . .	21	29·900	64	29·800	74	44	45	51	52	66	64	N. E.	2	·030	Breezy, sunshine, with light showers.
14 Thursday, . . .	22	30·250	60	30·165	70	47	45	51	53	62	60	N. W.	4	. .	Breezy, sunshine, and changeable.
15 Friday, ...	23	30·100	59	30·021	69	51	44	51	54	62	60	S. W.	2	·030	Light showers, changeable, fine day.
16 Saturday, . . .	24	30·090	60	30·005	71	41	40	50	52	64	62	N. W.	6	. .	Fine sunshiny day.
17 Sunday, . . .	25	30·095	63	30·005	70	40	40	50	53	64	60	N. W.	8	. .	Bright sunny day.
18 Monday, . . .	26	30·000	56	29·926	65	53	39	51	54	58	56	S. E.	0	·120	Dull and gloomy, showery, overcast.
19 Tuesday, . . .	27	29·900	66	29·801	75	52	40	54	56	66	55	S. E.	6	·100	Clear and mild, A. M., changeable, P. M.
20 Wednesday, . .	28	29·660	60	29·577	70	46	40	52	54	61	59	S. W.	5	·030	Fine sunshiny day, clear and breezy.
21 Thursday, . . .	29	29·640	57	29·567	68	49	40	62	54	59	57	S. W.	0	. .	Strong breeze, changeable, slight rain.
22 Friday, . . .	●	29·698	58	29·620	69	46	40	51	54	58	57	S. E.	6	·070	Slight rain, breezy fine day.
23 Saturday, . . .	1	29·240	48	29·189	60	45	40	49	51	46	46	S. W.	0	·530	
24 Sunday, . . .	2	29·690	61	29·410	71	46	40	55	52	62	61	S. W.	4	. .	Fine breezy day with occasional sunshine.
25 Monday, . . .	3	29·416	61	29·836	70	50	40	51	53	60	59	S. W.	5	·050	Thunder, strong breeze, showery, changbl.
26 Tuesday, . . .	4	29·698	62	29·510	74	50	40	52	54	65	62	S. W.	6	. .	Very stormy, fair and changeable.
27 Wednesday, . .	5	29·980	62	29·892	77	49	40	52	54	65	61	S. W.	6	·050	Fine sunshiny day.
28 Thursday, . .	6	30·100	62	30·010	79	49	40	53	54	64	63	S. E.	5	. .	Breezy, bright sunshine, fine day.
29 Friday, ...	7	29·900	69	29·796	80	48	40	56	57	72	69	S. W.	6	. .	Do.
30 Saturday, . . .	8	30·020	59	29·941	69	49	40	58	55	60	59	S. W.	8	. .	Do.
31 Sunday, . . .	9	30·020	61	29·935	70	62	40	54	55	62	61	E.	5	. .	Fine, bright sunshiny day.
													161	1·090	inches.

JUNE, 1868.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Monday, . . .	10	29·926	65	29·832	77	47	40	54	56	65	65	S. W.	7	. .	Fine breezy day, bright sunshine.
2 Tuesday, . .	11	29·978	58	29·900	70	58	40	53	56	57	57	W.	5	. .	Showery A. M., bright sun P. M., calm.
3 Wednesday, .	12	29·972	61	29·889	72	63	40	53	55	60	60	S. W.	7	·110	Fine breezy day, changeable.
4 Thursday, . .	13	30·000	57	29 926	71	56	49	52	55	59	59	S. W.	4	·030	Cloudy, overcast, fine and mild.
5 Friday, . . .	14	30·124	62	30·034	74	43	42	52	55	62	62	S. E.	8	. .	Bright sunshine, breezy, fine and mild.
6 Saturday, . .	15	30 060	62	29·970	72	59	40	55	57	62	62	S. W.	1	. .	Fine breezy day, changeable.
7 Sunday, . . .	16	30·290	57	30·246	66	44	42	52	55	58	56	N. W.	5	. .	Fine and breezy, changeable day.
8 Monday, . . .	17	30·290	54	30 222	65	47	40	50	56	56	56	N. W.	6	. .	Do.
9 Tuesday, . . .	18	30·140	58	30·061	69	51	45	52	54	59	57	N. W.	2	. .	Strong breeze, cloudy and changeable.
10 Wednesday, .	19	30·122	54	30·054	68	45	39	56	54	56	55	S. W.	0	. .	Dull and gloomy, brisk wind, changeable.
11 Thursday, . .	20	30 226	61	30·141	71	56	50	55	55	62	61	W.	0	·030	Calm, sultry, warm, light rain.
12 Friday, . . .	21	30 272	65	30·175	76	50	46	54	56	68	66	S. W.	6	. .	Fine breeze, sunshiny day.
13 Saturday, . .	22	30·196	62	30·106	73	51	47	55	58	62	62	S. W.	3	. .	Cloudy, sunshine, breezy and mild.
14 Sunday, . . .	23	30·140	67	30·039	77	51	47	56	58	69	67	S. W.	8	. .	Fine, breezy, sunshiny day.
15 Monday, . . .	24	30·172	62	30 082	79	55	50	57	59	66	64	S. W.	3	. .	Light showers, cloudy, mild and changeable.
16 Tuesday, . . .	25	30·198	67	30·097	78	48	45	57	59	69	68	S. W.	4	. .	Cloudy, sultry, warm, occasional sunshine.
17 Wednesday, .	26	30·200	65	30·105	75	59	45	58	60	66	65	W.	4	. .	Brisk wind, sunshine, fine day.
18 Thursday, . .	27	30·220	67	30·119	77	51	44	58	60	66	65	S. E.	6	. .	Do.
19 Friday, . . .	28	30·150	68	30·044	79	58	44	59	61	69	68	S. E.	6	. .	Fine sunshiny day.
20 Saturday, . .	●	29·930	73	29·815	80	51	44	61	62	76	75	S. E.	6	. .	Strong breeze, changeable.
21 Sunday, . . .	1	29·730	60	29·647	71	51	45	59	61	62	61	S. E.	0	·030	Dark, cloudy, light showers.
22 Monday, . . .	2	29·640	63	29·552	75	59	46	57	59	66	65	S. E.	6	.330	Sultry warm day, changeable.
23 Tuesday, . .	3	29·622	65	29·555	70	59	49	57	59	67	65	S. W.	6	·090	Brisk wind, cloudy, sunshine, fine and mild.
24 Wednesday, .	4	29·972	61	29 889	70	56	48	56	59	62	60	N. W.	5	·100	Cloudy and changeable, sunshine, mild.
25 Thursday, . .	5	30·108	64	30·013	74	58	47	57	59	66	64	N. W.	6	. .	Bright sun, breezy fine day.
26 Friday, . . .	6	30·246	63	30·260	72	56	41	57	58	63	61	S. E.	6	. .	Brisk wind, bright sun, fine day.
27 Saturday, . .	7	30·270	74	30·148	84	60	50	60	61	75	74	S. W.	6	. .	Sultry, very warm, breezy, hot sunshine.
28 Sunday, . . .	8	30·312	62	30·222	75	64	42	59	61	66	65	S. W.	2	. .	Fine, changeable, overcast, sunshine.
29 Monday, . .	9	30·380	71	30 278	79	65	44	61	62	69	67	S. W.	6	. .	Hot sunshine, light breeze, clear, calm.
30 Tuesday, . .	10	30·390	66	30·189	78	68	56	61	64	69	67	E.	0	. .	Dull and gloomy, calm, sultry, changeable.
													128	·720	inches.

JULY, 1868.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Cor-rected.	Max.	Min	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Wednesday, . .	11	30·450	73	30·333	82	67	49	63	64	74	72	E.	6	. .	Hot sun, brisk wind, clear fine day.
2 Thursday, . .	12	30·272	77	30·145	84	64	49	64	66	77	71	E.	6	. .	Sultry, calm, clear, bright sun.
3 Friday, . . .	13	30.156	75	30·028	78	57	50	55	57	78	76	S. E.	6	. .	Hot sun, clear, calm fine day.
4 Saturday, . .	14	30·110	64	30·105	67	52	49	41	64	60	65	N. W.	1	. .	Dull, cloudy, sultry, changeable.
5 Sunday, . . .	15	30·140	66	30·109	69	49	43	59	62	68	67	N. W.	2	. .	Fine and breezy, occasional sunshine.
6 Monday, . . .	16	30·080	62	29·990	64	48	43	58	61	63	62	N. W.	0	. .	Dull and gloomy, changeable.
7 Tuesday, . . .	17	30·060	70	29·989	72	56	50	61	63	71	70	S. W.	4	. .	Fine breezy day, cloudy and changeable.
8 Wednesday, . .	18	30·060	65	29·965	66	61	50	51	53	65	64	S. W.	0	·090	Heavy showers, dull and gloomy, breezy.
9 Thursday, . .	19	30·240	60	30·153	64	56	51	60	62	63	67	N. E.	2	·080	Dull and gloomy, mild and calm, fine day.
10 Friday, . . .	20	30·134	66	30·136	70	56	50	62	64	68	67	N. E.	2	. .	Dull and breezy, occasional sunshine.
11 Saturday, . .	21	30·186	73	29·999	75	52	50	62	63	73	70	N. E.	5	. .	Fine breezy sunshiny day.
12 Sunday, . . .	22	30·148	68	30·040	69	51	44	61	63	68	66	N. E.	3	. .	Fine breezy day, occasional sunshine.
13 Monday, . . .	23	30·148	69	30 042	83	59	46	62	64	69	68	E.	6	. .	Fine clear sunshiny day.
14 Tuesday, . . .	24	30·096	76	29·879	86	57	48	63	65	79	77	S. W.	6	. .	Warm and sultry, breezy fine day.
15 Wednesday, .	25	29·990	80	29·854	88	61	50	65	67	81	78	S. W.	6	. .	Very warm, clear sunshine.
16 Thursday, . .	26	29·940	64	29·846	68	57	46	63	66	65	64	N. W.	0	·070	Dull and gloomy, calm and mild.
17 Friday, . . .	27	30·064	66	29·996	69	49	46	61	63	66	65	N. E.	5	. .	Breezy and changeable, cloudy.
18 Saturday, . .	28	29·912	64	29·820	70	50	44	61	63	65	64	N. W.	0	·030	Dark and cloudy, light showers.
19 Sunday, . . .	●	30·096	70	29·985	76	49	46	61	63	73	70	S. W.	6	. .	Fine breezy sunshiny day.
20 Monday, . . .	1	29·964	72	29·849	76	56	51	63	64	71	70	S. W.	2	. .	Dull and gloomy, strong breeze, like rain.
21 Tuesday, . . .	2	30·050	77	29·923	81	61	50	66	66	78	76	S. E.	6	. .	Warm and sultry, breezy, hot sunshine.
22 Wednesday, . .	3	29·950	74	29·832	76	59	54	61	63	71	69	S. E.	3	. .	Warm & sultry, breezy, with occas. sunsh.
23 Thursday, . .	4	30·292	66	30·191	71	51	48	63	66	62	66	N. W.	5	. .	Fine and breezy, warm sunshiny day.
24 Friday, . . .	5	30·462	67	30·361	72	43	44	62	65	67	64	S. E.	6	. .	Do.
25 Saturday, . .	6	30·294	64	30·199	70	43	42	61	62	66	64	N. E.	5	. .	Do.
26 Sunday, . . .	7	30·024	74	29·902	78	43	44	63	64	74	70	S. E.	6	. .	Fine warm sunshiny day.
27 Monday, . . .	8	29·900	74	29·780	81	43	50	64	66	78	76	S. W.	6	. .	Hot and sultry, calm and changeable.
28 Tuesday, . . .	9	22·464	68	29·363	71	54	48	63	65	66	65	S. E.	2	. .	Strong breeze, changeable, like rain.
29 Wednesday, . .	10	29·650	60	29·567	70	43	48	57	61	61	60	N. W.	0	·370	Heavy rain, strong wind, dark and cloudy.
30 Thursday, . .	11	29·924	66	29·827	74	45	44	58	61	71	69	S. E.	1	. .	Fine and breezy, dark and cloudy.
31 Friday, . . .	12	30·200	64	30·105	69	51	50	58	61	66	63	N. W.	6	. .	Fine and breezy, bright sunshiny day.
													119	·640 inches.	

AUGUST, 1868.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In earth.		Dry.	Wet.	Direction.			
								5 in.	10 in.						
			°		°	°	°		°	°	°				
1 Saturday, . . .	13	30·240	73	30·123	77	51	49	61	63	72	70	S. E.	4	. .	Fine, overcast, sunshine, calm, sultry.
2 Sunday, . . .	14	30·092	72	29·975	76	46	45	61	63	72	68	N. E.	6	. .	Fine, breezy, warm, bright, sunshiny day.
3 Monday, . . .	15	29·950	72	29·835	77	51	49	63	65	75	72	S. W.	6	. .	Fine, breezy day, mild, hot sun occasional.
4 Tuesday, . . .	16	29·900	77	29·833	83	59	55	65	67	80	79	S. E.	6	. .	Very warm, sultry day.
5 Wednesday, . .	17	29·750	69	29·646	71	58	55	65	66	66	65	S. E.	3	·110	Cloudy, calm, mild and showery.
6 Thursday, . . .	18	29·600	66	29·501	70	57	55	63	65	67	65	S. W.	1	·110	Cloudy and changeable, mild fine day.
7 Friday, ...	19	29·572	64	29·778	69	51	49	60	63	66	63	S. W.	5	. .	Strong breeze, clear sun, changeable.
8 Saturday, . . .	20	29·856	64	29·762	70	51	51	60	63	66	64	S. W.	4	. .	Strong breeze, changeable, clouded sun.
9 Sunday, . . .	21	30·020	68	29·914	74	48	46	60	62	71	68	S. W.	4	. .	Fine, breezy, warm, sunshiny day.
10 Monday, . . .	22	29·936	68	29·832	73	51	45	60	63	70	68	S. E.	5	. .	Do.
11 Tuesday, . . .	23	29·526	57	29·455	70	52	51	57	61	59	58	N. W.	0	1·000	Dark, cloudy, heavy rain.
12 Wednesday, . .	24	29·594	63	29·407	67	48	47	57	60	62	61	S. E.	0	. .	Dark, cloudy, changeable day.
13 Thursday, . . .	25	29·382	59	29·305	61	51	51	57	59	60	59	E.	0	1·480	Dark, gloomy, showery day.
14 Friday, ...	26	29·528	60	29 446	62	49	47	56	58	60	59	S. E.	2	·090	Strong breeze, cloudy, changeable.
15 Saturday, . . .	27	29·726	64	29·634	67	53	50	57	59	62	61	S. E.	1	·060	Showery, breezy, changeable.
16 Sunday, . . .	28	29·936	70	29·855	71	49	49	58	60	72	69	S. E.	6	·070	Fine, bright sunshine, warm day.
17 Monday, . . .	29	29·912	70	29·803	73	51	50	60	61	70	67	N. W.	6	. .	Bright sunsh., changeable, calm & mild.
18 Tuesday, . . .	●	29·838	59	29·761	62	50	49	58	61	61	59	N. W.	0	. .	Breezy, cloudy, and changeable.
19 Wednesday, . .	1	30·000	63	29·910	65	50	47	56	59	64	62	N. W.	5	. .	Bright sunshine, changeable, calm day.
20 Thursday, . . .	2	30·000	64	29·905	69	42	41	56	58	68	66	S. E.	4	. .	Fine, breezy, mild, and changeable, cloudy.
21 Friday, ...	3	29·922	63	29·835	63	50	47	55	58	62	60	N. W.	5	. .	Fine, mild, with occasional sunshine.
22 Saturday, . . .	4	29·160	55	29·004	53	52	49	54	57	52	52	N. W.	0	1·300	Very stormy, wet, changeable.
23 Sunday, . . .	5	29·640	57	29·599	58	49	45	52	55	56	55	N. W.	2	·050	Breezy, changeable, showery, occas. suns.
24 Monday, . . .	6	29·772	57	29·701	59	50	47	52	56	58	57	N. W.	3	·070	Do. occasional sunshine.
25 Tuesday, . . .	7	30·020	58	29·941	60	47	45	53	56	60	58	N. W.	4	·060	Occasional suns., strong breeze, changeable.
26 Wednesday, . .	8	29·792	60	29·709	62	52	45	54	56	61	60	S. W.	0	·040	Strong breeze, showery, dull, & gloomy.
27 Thursday, . . .	9	29·916	58	29·836	61	51	45	54	56	59	58	N. W.	5	. .	Strong breeze, sunshine, changeable.
28 Friday, ...	10	30·142	59	30·063	60	50	46	52	55	58	56	S. W.	3	. .	Breezy, changeable, occasional sunshine.
29 Saturday, . . .	11	30·200	63	30·110	66	48	45	54	56	65	64	S. E.	5	. .	Fine, calm, bright sunshine.
30 Sunday, . . .	12	30·062	68	30·056	68	61	52	57	58	67	66	S. W.	2	·030	Breezy, warm, changeable, occas. suns.
31 Monday, . . .	13	30·092	61	30·007	63	45	43	55	57	62	61	N. W.	4	. .	Fine, breezy, warm sunshine.
													101	4.470	inches.

SEPTEMBER, 1868.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth.		Dry.	Wet.	Direction.			
								5 in.	10 in.						
			°		°	°	°	°	°	°	°				
1 Tuesday, . . .	14	30·150	65	30·055	67	52	52	57	58	66	65	S. W.	8	. .	Fine, breezy, with occasional sunshine.
2 Wednesday, . .	15	30·196	68	30·090	71	46	48	56	58	70	68	E.	5	. .	Fine, mild, warm, bright sunshine.
3 Thursday, . . .	16	30·050	72	29·933	74	46	48	59	60	73	71	S. W.	8	. .	Do. occasional sunshine.
4 Friday . . .	17	30·050	72	29·933	76	57	52	60	61	73	71	N. W.	6	. .	Fine, breezy, bright sunshine.
5 Saturday, . . .	18	30·150	71	30·037	75	53	49	60	61	72	70	S. E.	6	. .	Fine, warm, bright sunshine.
6 Sunday, . . .	19	30·040	72	29·923	75	57	54	61	62	70	72	E.	2	. .	Fine, mild, bright sunshine.
7 Monday, . . .	20	30·048	65	29·953	67	56	54	60	62	66	65	N. W.	0	. .	Fine, mild, cloudy, changeable.
8 Tuesday, . . .	21	30·320	60	30·235	62	45	43	58	60	61	59	N. E.	5	. .	Fine, breezy, occasional sunshine.
9 Wednesday, . .	22	30·350	62	30·260	65	47	42	57	59	64	63	S. E.	4	. .	Fine, mild, occasional sunshine.
10 Thursday, . . .	23	30·150	70	30·039	75	46	44	57	58	75	71	S. W.	6	. .	Fine, mild, bright sunshine.
11 Friday, ...	24	30·040	58	29·961	58	46	50	57	59	57	56	N. E.	0	. .	Cloudy, like rain.
12 Saturday, . . .	25	30·040	56	29·966	57	46	51	57	58	56	55	N. E.	0	. .	Cloudy, breezy, changeable.
13 Sunday, ...	26	30·050	57	29·976	59	50	46	55	57	58	56	N. E.	5	. .	Fine, breezy, occasional sunshine.
14 Monday, . . .	27	29·980	54	29·913	56	49	42	57	56	54	53	N. E.	0	. .	Breezy, cold, gloomy, and changeable.
15 Tuesday, . . .	28	29·992	54	29·925	55	48	45	52	55	54	53	S. E.	0	. .	Do.
16 Wednesday, . .	●	29·910	59	29·833	63	48	44	55	57	63	61	S. E.	2	. .	Fine, breezy, occasional sunshine.
17 Thursday, . . .	1	29·680	60	29·598	61	50	49	56	57	61	60	S. E.	2	. .	Do.
18 Friday, ...	2	29·600	57	29·529	58	54	50	54	56	57	56	E.	0	. .	Do. changeable, like rain.
19 Saturday, . . .	3	29·496	58	29·419	60	54	50	55	57	61	59	E.	2	·240	Breezy, showery, occasional sunshine.
20 Sunday, . . .	4	29·488	57	29·417	60	54	50	55	57	62	60	N. E	0	·090	Cloudy, breezy, showery, changeable.
21 Monday, . . .	5	29·722	62	29·633	64	57	52	57	58	65	63	S. E	8	·190	Fine, breezy occasional, sunshine.
22 Tuesday, . . .	6	29·828	62	29·741	63	50	46	56	58	63	61	N. E	4	. .	Fine, mild, warm, occasional sunshine.
23 Wednesday, . .	7	29·720	58	29·643	62	46	44	54	56	62	60	S. W.	2	. .	Do.
24 Thursday, . . .	8	29·650	56	29·579	58	48	44	53	55	58	57	W.	1	·020	Mild, showery, occasional sunshine.
25 Friday, ...	9	29·472	55	29·406	56	42	40	52	54	56	55	E.	0	·050	Stormy, showery, changeable.
26 Saturday, . . .	10	29·496	57	29·425	59	50	45	52	54	58	57	S. E.	0	1·080	Showery, breezy, changeable.
27 Sunday, . . .	11	29·300	57	29·229	60	49	45	52	54	59	58	S. E.	2	·260	Mild, showery, occasional sunshine.
28 Monday, . . .	12	29·230	58	29·153	60	43	41	52	54	58	57	S. E.	8	. .	Fine, breezy, occasional sunshine.
29 Tuesday, . . .	13	28·892	58	28·817	59	43	48	52	54	58	57	S. W.	1	·260	Showery, breezy, occasional sunshine.
30 Wednesday, . .	14	29·200	56	29·129	60	52	50	53	55	58	56	S. E.	2	·100	Showery and changeable, mild, fine day.
													69	2.290	Inches.

OCTOBER, 1868.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN. IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Thursday, . .	15	29·920	50	29·863	52	48	44	51	53	51	50	N. E.	3	. .	Breezy, cold, changeable, occas. sunshine.
2 Friday, . . .	16	30·128	55	30·060	58	40	36	49	52	57	56	S. E.	4	. .	Fine, warm, mild, occasional sunshine.
3 Saturday, . .	17	29·800	49	29·748	32	41	40	47	51	52	51	S. E.	0	. .	Mild, dark, cloudy, changeable.
4 Sunday, . . .	18	29·708	51	29·651	53	46	43	48	51	53	52	W.	1	. .	Cloudy, changeable, occasional sunshine.
5 Monday, . . .	19	29·928	52	29·866	55	35	33	47	50	56	53	S. E.	4	. .	Fine, changeable, occasional sunshine.
6 Tuesday, . . .	20	29·760	54	29·693	56	51	46	49	51	56	54	S. W.	0	·200	Fine, breezy, cloudy, changeable.
7 Wednesday, .	21	29·942	52	29·880	54	41	39	47	50	58	51	W.	4	. .	Fine, breezy, bright, sunshine.
8 Thursday, . .	22	29·938	54	29·871	57	45	44	47	49	56	55	S. W.	0	. .	Fine, mild, cloudy, changeable.
9 Friday, . . .	23	29·712	57	29·639	60	52	50	50	51	58	56	W.	0	. .	Fine, mild, warm, cloudy, changeable.
10 Saturday, . .	24	29·994	53	29·932	56	41	41	48	50	56	55	E.	0	·020	Showery, mild, changeable.
11 Sunday, . . .	25	30·064	57	29·990	60	43	41	49	51	59	57	S. E.	3	. .	Fine, breezy, occasional sunshine.
12 Monday, . . .	26	29·940	55	29·873	59	40	40	48	50	58	57	S. W.	0	. .	Fine, mild, cloudy, changeable.
13 Tuesday, . .	27	30·120	53	30·059	55	49	49	49	51	54	53	N. W.	2	. .	Fine, mild, occasional sunshine.
14 Wednesday, .	28	30·120	50	30·057	55	38	40	47	50	55	53	E.	3	. .	Fine, mild, changeable, occas. sunshine.
15 Thursday, . .	●	29·634	56	29·561	58	53	51	50	51	57	55	S. W.	2	. .	Stormy, changeable, occasional sunshine.
16 Friday, . . .	1	29·426	50	29·370	51	44	44	47	50	50	49	N. W.	2	·050	Showery, stormy, changeable, occas. sunsh.
17 Saturday, . .	2	29·520	45	29·479	47	37	37	44	47	47	45	W.	3	·060	Cold, breezy, changeable, occas. sunshine.
18 Sunday, . . .	3	29·676	42	29·640	45	32	33	41	45	45	44	N. W.	3	. .	Cold, breezy, changeable, occas. sunshine.
19 Monday, . . .	4	29·814	45	29·773	48	33	33	41	44	48	46	N. W.	4	. .	Fine, cold, breezy, bright sunshine.
20 Tuesday, . .	5	29·800	42	29·764	48	35	36	41	44	47	46	S. E.	0	. .	Fine, mild, cloudy, changeable.
21 Wednesday, .	6	29·728	46	29·682	49	38	37	42	44	48	47	N. W.	3	·130	Fine, cold, breezy, changeable, occ. sunsh.
22 Thursday, . .	7	29·968	48	29·916	52	36	36	42	44	52	50	W.	4	.	Fine, breezy, changeable, occas. sunshine.
23 Friday, . . .	8	29·768	48	29·716	50	40	39	44	45	51	48	W.	3	. .	Fine, cold, breezy, changeable, occas. sunsh.
24 Saturday, . .	9	29·100	52	29·039	59	41	40	44	45	59	58	S. W.	0	·170	Showery, stormy, changeable.
25 Sunday, . . .	10	29·678	50	29·621	53	47	46	45	45	52	51	W.	0	. .	Fine, mild, cloudy, changeable.
26 Monday, . . .	11	29·850	49	29·798	51	41	40	44	46	50	48	N. W.	3	. .	Fine, breezy, cold, changeable occas. sunsh.
27 Tuesday, . . .	12	30·162	46	30·115	50	37	36	42	45	50	48	N. W.	4	. .	Do.
28 Wednesday, .	13	30·100	45	30·058	48	37	37	41	44	48	47	S. W.	0	. .	Cloudy, breezy, changeable.
29 Thursday, . .	14	29·800	46	29·754	48	41	40	42	44	47	45	N. W.	3	·140	Fine, breezy, cold, occasional sunshine.
30 Friday, . . .	15	30·142	49	30·090	51	42	41	43	44	51	50	S. W.	0	. .	Cloudy, breezy, changeable.
31 Saturday, . .	16	30·014	58	29·935	60	47	46	46	47	59	58	S. W.	3	. .	Fine, breezy, changeable, occas. sunshine.
													61	·770	inches.

NOVEMBER, 1868.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
1 Sunday, . .	17	29·882	61°	29·799	62°	56°	54°	50°	50°	62°	60°	S. W.	2	·050	Fine, breezy, changeable, occas. sunshine.
2 Monday, . .	18	30·076	50	30·018	51	46	40	46	49	51	49	W.	4	·170	Fine, mild, changeable, occasional sunshine.
3 Tuesday, . .	19	29·688	52	29·626	53	47	45	46	48	53	51	N. W.	0	. .	Stormy, cold, changeable.
4 Wednesday, .	20	29·576	48	29·525	49	47	45	46	48	48	47	S. W.	2	·070	Showery, breezy, changeable, occas. sunsh.
5 Thursday, . .	21	29·764	41	29·730	44	34	33	41	45	44	43	N. W.	4	. .	Fine, breezy, bright sunshine.
6 Friday, . . .	22	29·950	38	29·925	41	30	29	38	42	41	40	N. W.	4	. .	Fine, breezy, cold, bright sunshine.
7 Saturday, . .	23	30·076	36	30·046	40	27	27	36	40	40	38	N. W.	3	. .	Fine, cold, changeable, occasional sunshine.
8 Sunday, . .	24	29·938	45	29·897	48	38	36	39	41	47	46	W.	1	·090	Fine, cloudy, changeable, mild, occas. sunsh.
9 Monday, . .	25	30·200	44	30·158	47	36	34	40	42	47	45	N. E.	3	. .	Fine, breezy, changeable, occasional sunshine.
10 Tuesday, . .	26	30·128	42	30·092	44	38	35	40	41	44	42	E.	0	·080	Cloudy, cold, showery, changeable.
11 Wednesday, .	27	30·100	43	30·064	48	32	32	39	41	49	47	S. E.	3	. .	Fine, cold, bright sunshine.
12 Thursday, . .	28	30·450	49	30·398	52	40	36	40	42	52	50	S. E.	4	. .	Fine, mild, bright sunshine.
13 Friday, . . .	29	30·600	43	30·564	47	37	36	40	42	47	46	N.	1	. .	Fine, mild, cloudy, occasional sunshine.
14 Saturday, .	●	30·368	42	30·332	46	34	34	39	41	46	45	N. W.	1	. .	Do.
15 Sunday, . .	1	30·364	44	30·322	46	43	41	40	42	46	45	N. E.	2	·040	Showery, cold, changeable, occas. sunshine.
16 Monday, . .	2	30·238	41	30·207	43	40	37	40	41	43	42	N. E.	0	. .	Fine, cold, cloudy, changeable.
17 Tuesday, . .	3	30·276	46	30·229	48	42	40	40	42	47	46	S. E.	0	. .	Do.
18 Wednesday, .	4	30·328	44	30·286	46	44	43	41	42	45	44	E.	0	. .	Fine, mild, cloudy, changeable.
19 Thursday, . .	5	30·324	44	30·282	45	43	42	41	42	45	44	S. E.	0	. .	Fine, breezy, cold, changeable.
20 Friday, . . .	6	30·028	43	29·992	44	42	41	40	42	45	43	S. E.	0	·030	Fine, cloudy, breezy, cold, changeable.
21 Saturday, . .	7	29·386	48	29·335	50	43	42	42	43	50	49	S. W.	1	·280	Breezy, cloudy, changeable, like rain.
22 Sunday, . . .	8	28·926	48	28·877	50	47	45	43	44	49	48	W.	0	·040	Mild, showery, changeable.
23 Monday, . .	9	29·368	42	29·333	45	38	38	41	43	44	43	N. W.	3	·300	Fine, breezy, cold, bright sunshine.
24 Tuesday, . .	10	29·760	36	29·740	41	30	31	38	41	41	40	N.	3	. .	Fine, mild, frosty, bright sunshine.
25 Wednesday, .	11	29·238	47	29·193	49	36	33	40	41	48	47	S. W.	0	·090	Stormy, wet, changeable.
26 Thursday, . .	12	29·788	45	29·747	47	45	42	41	42	47	46	N. E.	0	·050	Mild, cloudy, changeable, like rain.
27 Friday, . . .	13	29·950	40	29·920	43	37	36	40	42	42	42	N. W.	0	·200	Mild showery, changeable.
28 Saturday, . .	14	29·846	38	29·821	41	38	38	40	42	40	40	S. W.	1	·050	Mild, foggy, changeable, occas. sunshine.
29 Sunday, . . .	15	29·612	46	29·566	47	37	35	40	42	47	46	S. E.	0	·020	Strong breeze, wet, changeable.
30 Monday, . .	16	29·350	46	29·305	48	45	44	41	42	48	48	S. E.	0	·140	Do.
													12	1.700	inches.

DECEMBER, 1868.

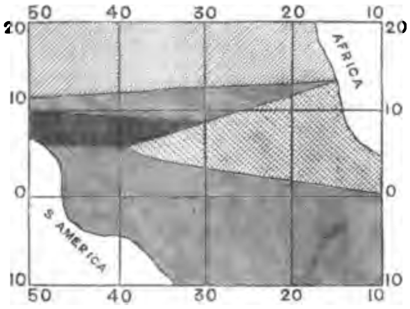
DATE.	MOON'S AGE.	BAROMETER.			THERMOMETERS.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
1 Tuesday, . . .	17	29·574	47°	29·528	49°	47°	46°	44°	45°	49°	48°	S. E.	0	·050	Fine, mild, cloudy, changeable.
2 Wednesday, . .	18	29·562	46	29·516	49	35	35	41	43	49	48	S. W.	0	. .	Fine, breezy, cloudy, changeable.
3 Thursday,. . .	19	29 840	51	29·284	54	48	47	44	45	53	52	S. W	2	·270	Fine, breezy, changeable, occas. sunshine.
4 Friday, . . .	20	29·072	56	29·001	59	49	48	46	46	60	57	S. E.	1	·040	Do.
5 Saturday,. . .	21	29·078	52	29·017	52	50	47	45	46	52	51	S.	1	·100	Showery, changeable, occasional sunshine.
6 Sunday, . . .	22	29·332	48	29·281	50	48	45	44	46	50	49	S. E.	0	130	Foggy, mild, changeable, like rain.
7 Monday, . . .	23	29·684	49	29·632	51	46	44	44	45	51	49	S. W.	2	·760	Fine, breezy, changeable, occas. sunshine.
8 Tuesday, . . .	24	29·276	47	29·230	49	45	41	43	45	49	49	N. E.	0	·490	Showery, mild, changeable.
9 Wednesday, . .	25	30·072	40	30·041	42	39	37	42	44	42	41	N. E.	0	·090	Foggy, mild, changeable.
10 Thursday,. . .	26	29·416	55	29 850	56	42	42	45	46	57	55	S. W.	1	·100	Stormy, changeable, occasional sunshine.
11 Friday,. . . .	27	29·124	46	29·079	47	46	43	45	47	46	45	N. W.	0	·060	Mild, cloudy, changeable, like rain.
12 Saturday, . . .	28	29·726	42	29 690	43	40	37	41	44	43	42	S. E.	0	·070	Strong, breezy, cold, changeable.
13 Sunday, . . .	29	29·468	44	29·420	45	41	40	42	44	44	45	S. E.	0	. .	Fine, breezy, cloudy, changeable.
14 Monday, . . .	●	28·928	54	28·863	57	44	43	44	45	56	54	S. W.	1	·100	Breezy, showery, changeable, occas. suns.
15 Tuesday, . . .	1	29·220	49	29·167	51	47	44	44	46	52	51	S. W.	2	·040	Fine, mild, bright sunshine.
16 Wednesday, . .	2	29·118	45	29·090	48	43	41	42	44	47	47	S. W.	2	·140	Fine, breezy, cold, changeable, occas. suns.
17 Thursday,. . .	3	29 538	44	29·497	48	41	39	41	43	48	47	S. E.	0	·090	Breezy, showery, mild, changeable.
18 Friday,. . . .	4	29·416	47	29·371	49	45	41	44	45	48	47	S. W.	2	·130	Fine, mild, changeable, occas. sunshine.
19 Saturday,. . .	5	29 614	38	29·589	43	31	31	39	45	45	43	N. W.	2	. .	Fine, breezy, bright sunshine.
20 Sunday, . . .	6	29·400	44	29·360	47	38	36	40	42	47	46	S. E.	0	·590	Mild, showery, changeable.
21 Monday, . . .	7	28·950	53	28·890	55	46	44	44	44	54	52	S. W.	2	·800	Strong, breezy, changeable, occas. sunshine.
22 Tuesday, . . .	8	29·036	48	28·985	51	44	42	43	44	51	49	S. W.	3	. .	Fine, mild, bright sunshine.
23 Wednesday, . .	9	29·076	42	29·041	45	37	34	40	43	46	45	S. W.	3	. .	Fine, breezy, cold, bright sunshine.
24 Thursday, .	10	28·744	41	28·715	42	40	36	40	42	42	42	N. W.	0	·220	Showery, breezy, cloudy, changeable.
25 Friday,. . . .	11	29·190	40	29·160	41	36	36	38	41	42	41	N. W.	0	·140	Do.
26 Saturday,. . .	12	29·128	40	29·090	44	36	35	43	45	44	43	S. W.	1	030	Stormy, showery, changeable, occas. suns.
27 Sunday, . . .	13	28·748	38	28·724	42	40	40	42	44	44	43	S. W.	1	·140	Stormy, changeable, occasional sunshine.
28 Monday, . . .	14	29·036	39	29·001	41	36	32	38	44	40	39	S. W.	0	·120	Cold, breezy, cloudy, changeable.
29 Tuesday, . . .	15	29·100	37	29·080	41	34	30	36	39	42	41	S. W.	3	·070	Fine, breezy, bright sunshine.
30 Wednesday, . .	16	29·468	34	29·454	37	30	29	34	37	37	36	N. W.	2	. .	Fine, cold, frosty, changeable, occas. suns.
31 Thursday,. . .	17	29 850	36	29·830	39	31	32	35	37	39	38	N. W.	3	.	Fine, frosty, bright sunshine.
													34	4·670	inches.

JANUARY, 1869.

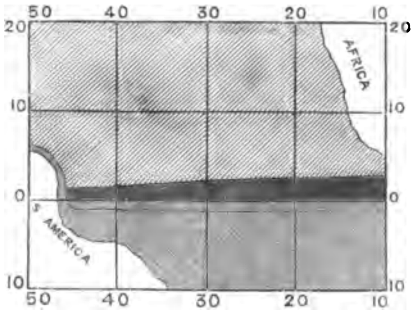
DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Friday, . . .	18	29·676	42	29·640	45	27	27	34	37	45	43	S. E.	0	. .	Strong, breezy, cloudy, changeable.
2 Saturday, . .	19	29·680	39	29·655	44	36	34	36	38	48	42	S.	0	. .	Fine, mild, cloudy, changeable.
3 Sunday, . . .	20	29·338	40	29·300	44	38	35	37	39	44	42	S. W.	2	·150	Fine, breezy, changeable, occas. sunshine.
4 Monday, . .	21	29·688	41	29·650	44	37	34	36	38	43	42	S. W.	2	·080	Do.
5 Tuesday, . .	22	29·398	46	29·353	47	41	39	40	40	47	45	N. W.	1	·240	Showery, stormy, changeable, occas. sunsh.
6 Wednesday, .	23	30·120	40	30·089	43	38	36	38	39	43	42	S. W.	0	. .	Fine, mild, cloudy, changeable.
7 Thursday, . .	24	30·160	34	30·145	39	30	30	35	38	40	39	N. W.	2	. .	Fine, foggy, changeable, occas. sunshine.
8 Friday, . . .	25	30·264	48	30 212	50	41	39	40	41	49	47	S. W.	2	. .	Fine, mild, changeable, occasional sunshine.
9 Saturday, . .	26	30·336	46	30·299	50	41	39	41	42	50	48	S. W.	0	. .	Fine, mild, cloudy, changeable.
10 Sunday, . .	27	30·030	47	29·993	48	46	43	41	42	48	47	S. E.	1	. .	Fine, mild, cloudy, changeable, occas. sunsh.
11 Monday, . .	28	30·024	46	29·977	49	46	43	42	43	48	47	S. E.	0	. .	Fine, mild, cloudy, changeable.
12 Tuesday, . .	●	29·986	47	29·940	50	44	42	42	43	50	49	E.	2	. .	Fine, mild, changeable, occasional sunshine.
13 Wednesday, .	1	29·828	44	29·787	45	44	43	42	43	45	44	S. E.	0	. .	Breezy, cold, changeable, like rain.
14 Thursday, . .	2	29·424	46	29·379	47	44	42	41	43	47	46	S. E.	0	. .	Strong, breezy, showery, changeable day.
15 Friday, . .	3	29·592	44	29·551	45	41	40	41	43	44	44	N. W.	1	·730	Breezy, cloudy, changeable, occas. sunshine.
16 Saturday, . .	4	29·800	50	29·747	53	41	40	42	43	53	52	S. W.	0	·290	Showery, mild, cloudy, changeable.
17 Sunday, . . .	5	29·994	46	29·948	47	41	40	43	44	46	45	S. W.	2	·450	Showery, breezy, changeable, occas. sunsh.
18 Monday, . .	6	30·150	47	30·103	50	32	33	41	43	50	49	S. W.	0	·220	Showery, mild, changeable.
19 Tuesday, . .	7	30·196	51	30·138	54	48	46	44	45	55	53	S. W.	0	. .	Fine, mild, cloudy, changeable.
20 Wednesday, .	8	30·050	49	29·998	51	48	46	43	44	50	49	S. W.	0	. .	Showery, breezy, cloudy, changeable.
21 Thursday, . .	9	30·150	42	30·114	44	41	40	42	44	44	43	N. E.	1	·630	Showery, mild, changeable, occas. sunshine.
22 Friday, . . .	10	30·216	43	30·180	44	42	39	41	43	44	44	N. E.	0	·070	Breezy, cold, cloudy, like rain.
23 Saturday, . .	11	29·916	42	29·880	45	35	32	40	42	45	43	S. E.	2	·060	Fine, breezy, changeable, occas. sunshine.
24 Sunday, . . .	12	30·000	37	29·980	41	32	30	38	41	40	39	N. W.	1	. .	Fine, foggy, changeable, occas. sunshine.
25 Monday, . .	13	29·796	45	29·755	47	36	31	39	41	45	44	S. W.	0	. .	Showery, mild, changeable.
26 Tuesday, . .	14	29·656	43	29·620	47	30	28	38	40	47	45	S. W.	1	·050	Breezy, foggy, changeable, occas. sunshine.
27 Wednesday, .	15	29·468	45	29·420	48	36	31	39	41	47	45	S. E.	0	. .	Strong, breezy, cloudy, changeable day.
28 Thursday, . .	16	29·176	45	29·135	49	39	34	40	42	49	47	S.	2	·280	Fine, mild, changeable, occasional sunshine.
29 Friday, . .	17	28·696	45	28·650	48	40	36	41	42	46	45	S. W.	1	·770	Strong, breezy, showery, changeable day.
30 Saturday, . .	18	29·258	46	29·213	49	40	36	39	41	49	47	S. W.	3	·080	Fine, breezy, bright sunshine.
31 Sunday, . . .	19	28·780	51	28·725	52	47	42	42	43	52	49	S. W.	2	·120	Very stormy, changeable, occas. sunshine.
													28	4·220	inches.

DIAGRAMS ILLUSTRATING THE OSCILLATION OF THE TRADE WINDS.

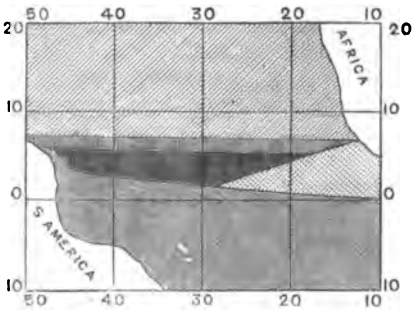
No. 1.—June to October.



No. 2.—October to January.



No. 3.—February to April.



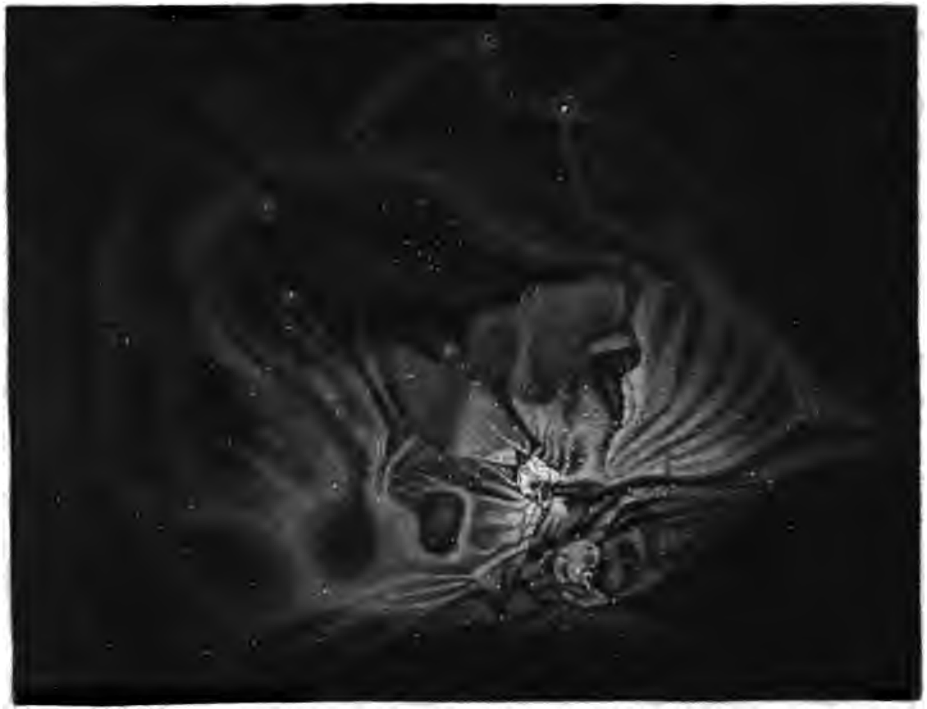
▨ S. E. Trade.

■ Calms.

▨ N. E. Trade.

▩ S. W. Monsoon.

NEBULA IN THE SWORD-HILT OF ORION.



As seen in LORD ROSSE'S telescope

D.J. Pound sculp^t

Vol. V.

No. XXXIX.] [Price 2s.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

CONTENTS:

PAGE.
1. Professor Purser on the Vibrations which give rise to Musical Sounds, . . . 429
2. Mr. Kirby's Natural History Excursion to the Continent, ... 436
3. Mr. Grubb on a recently observed Meteor, ... 444
4. Dr. Moore's Botanical and Horticultural Notes, ... 447
5. Dr. Reynolds on Hydrogen as a Gas, and as a Metal, ... 455
6. Mr. Grubb on the Great Melbourne Telescope, ... 460
7. Mr. Andrews on Deep Sea Soundings, ... 475
8. Mr. Adair on the Acclimation of Plants, ... 481
9. Mr. More on the Japanese Silkworm, ... 486
10. Mr. Hayes on Co-operative Farming, ... 489
11. Mr. Huggins on Results of Spectrum Analysis as applied to the Heavenly Bodies, 499
12. Dr. Macalister on the Æsthetical Relations of the Curves of the Human Spine, 508
13. Return of Donations to the Royal Dublin Society, ... 512
14. Intelligence:—
    - School of Art, ... 522
    - Evening Meetings, ... 538
    - Afternoon Scientific Lectures, ... 544
    - Annual Spring Cattle Show, ... 544
    - Conversazione, ... 544

Appendix—Meteorological Journal from February, 1869, to January, 1870, . . xliii
Index to Vol. V., ... lvii

DUBLIN:
HODGES, FOSTER, AND CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.
1870.

AUG 2 1917
LIBRARY

The Society

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

The Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Treasurer:—

Life Membership, ...	£21 0 0
Annual Membership (with £3 3s. Entrance Fee),	2 2 0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15s., £10 10s., or £5 5s., according to standing.

I.—MEETINGS OF THE SOCIETY AND THE COUNCIL.

1. *Stated and Ordinary Meetings.*

The Society meets at 3 o'Clock P.M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday of November.

The Council meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

2. *Evening Scientific Meetings.*

Meetings of the Society, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5s. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6*d*. each; or to twelve for 5s., available for any of the ordinary Meetings throughout the Session.

THE STANDING COMMITTEES.

Six Standing Committees are annually elected, as follows:—1. Agriculture; 2. Botany; 3. Fine Arts; 4. Library; 5. Natural History; 6. Practical Science.

[*For continuation, see page* 3 *of Cover.*

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

◆

XLI.—*On the Vibrations which give rise to Musical Sounds.* By PROFESSOR PURSER.

[Read May 1, 1869.]

Before entering upon the consideration of some of the recent contributions to the Theory of Sound which it is my purpose to bring under your notice, it will be desirable that we prepare the way by an examination of its elementary principles.

Sound cannot pass through empty space, as is proved by the old experiment of striking a bell under the receiver of an air pump. When the air is exhausted, the sound is quite inaudible to the ear of an observer placed close to the receiver. It follows that Sound must consist of some movement which, travelling through the intermediate air (or other interposing medium), strikes upon the auditory nerves.

Of what nature is this movement? Experience furnishes us with two distinct and well-marked types of motion, or rather with two different ways in which movement may be propagated to a distance. In the one we have a simultaneous transport of the movement and the body moved. This is the case with any vehicle or projectile. In the other type the movement is not that of a single body carried from place to place, but of a succession of particles, which in turn take up the impulse from the particles behind, and pass it on to those before, none of the particles being themselves more than slightly disturbed from their places.

The waves of the sea present to us the best known instance of this type of motion, and hence all such movement has received the name of undulatory or wave motion. If we watch any object—a boat, for instance—floating on the surface of the sea, we observe that, as the successive waves reach it, the boat simply rises and falls a little, while the waves pass on; and we thus see that the motion of the boat—or, which comes to the same thing, that of the water on which it floats—has no resemblance whatever to the motion of the wave. The water moves a few feet up and down—the wave is borne along with a speed exceeding that of the fastest ships.

It is to this second or undulatory form of movement we must refer the propagation of Sound. Air acts like a highly elastic spring. If a portion of it be suddenly compressed, it instantly expands again; but, encompassed as it is with other air, it cannot do so without compressing in its turn the portion immediately surrounding it. This, again, in recovering, acts upon the parts beyond; and so the layer or stratum of disturbance goes on, extending itself indefinitely in the form of a constantly enlarging spherical surface. Such is a wave of Sound.

Waves of water furnish us with a useful illustration of waves of Sound, enabling us to realize many of the more important features of wave-motion: the analogy between the two is however by no means perfect, and it will be well to note in what the difference consists.

The motion of the particles of air, through which a Sound-wave is passing, is to and fro, or in the line of the wave's motion. The motion of the sea is up and down, or across the direction of the wave's motion.

Again, they differ in the force which propagates them. The sea waves are propagated by the force of gravity, in virtue of which the surface of the water always tends to return to the form of a level plane after any disturbance. Waves of Sound, on the other hand, are propagated, not by gravity, but by the elasticity of the medium through which they travel. It is true water may convey Sound, but it is in its capacity of an elastic medium that it does so.

The rate at which the Sound-wave travels is determined by the rapidity with which the medium, when disturbed by the wave passing through it, recovers its undisturbed condition. The rapidity with which such restoration is effected depends upon two things—one, the force which causes the disturbed medium to spring back; the other, the inertia or sluggishness displayed by the particles of the medium in yielding to this force—in other words, upon the elastic force, and upon the density of the medium. The greater the elastic force, the more rapidly—the greater the density, the more slowly—will the restoration be established.

Thus water is some eight hundred times heavier than air; and as far, therefore, as its inertia is concerned, should convey Sound far more slowly; but its elastic force—the force with which it springs back after compression—exceeds that of air in a far greater ratio. This far more than compensates for its greater inertia, and accordingly water conveys Sound four times as fast as air does.

All gases under the same pressure have the same elastic force; so that, in comparing one gas with another in respect of the velocity of the Sound-wave passing through them, we need only consider their relative densities. The lighter the gas, the faster will it carry Sound; thus hydrogen carries Sound far faster than common air, and hot air faster than cold air.

At ordinary temperatures the velocity of Sound through the air is about 1100 feet per second.

You will notice I have always spoken of the velocity with which

Sound is conveyed, not distinguishing what sounds, thereby implying that all sounds travel with the same velocity. This, which is an immediate deduction from the principles of wave-motion, is abundantly confirmed by experience.

The waves of air set in motion by a sounding body seldom occur singly, but we almost always find a series of such waves following each other in rapid succession; when the intervals at which the waves succeed each other are irregular the Sound is toneless, what we call a *noise*, but when wave follows wave at close and regular intervals after the manner of the ripples started by the fall of a stone in a pool of water, the Sound has a distinct musical tone. This element of regularity in the vibrations which produce musical tones renders them peculiarly appropriate for scientific investigation, and to the consideration of such vibrations we shall here confine ourselves. The condition requisite for the production of such a musical note is simply this, that a succession of blows or disturbances should be impressed upon the air at very short and regular intervals. The musical tone arises, not from anything musical in the separate blows, but solely from the regularity of their succession.

[*This was illustrated by the note produced* (1) *by a piece of cardboard held to the notches of a rapidly revolving wheel,* (2) *by the successive puffs of air forced by a bellows through a Syren.*]

You observe, in both these instances, that the more rapid the succession of the vibrations the higher is the pitch of the note, the ratios between the number of vibrations per second of the different notes of the diatonic scale being expressed by very simple numbers. Thus, for the octave, this ratio is, 1 : 2; for the major fifth, 2 : 3; for the fourth, 3 : 4; for the major third, 4 : 5, &c. In other words, to every 1 vibration of the fundamental answer 2 of the octave; to 2 of the fundamental answer 3 of the fifth, &c.

A stretched string produces a musical note on the same principle as the Syren, that of impressing upon the air a rapid and regular succession of blows. When the string is drawn to one side by the finger, and let go, it springs back, but like all springs it does not stop at the central line, but is carried past by its own impetus to the same distance on the opposite side, and thus keeps vibrating backwards and forwards till the effect of the original disturbance is lost. The air is thus thrown into a state of vibration partly by the direct blows given to it by the string and partly by the blows it receives from the sounding board which vibrates in sympathy with the string.

The laws of vibrating strings are conveniently studied by means of the monochord, an instrument consisting simply of a wire stretched over a sounding board, which we can shorten at pleasure by means of a moveable bridge.

Now, mathematics teach us that, as long as the tension of a given wire remains unaltered, the number of vibrations executed in a second varies inversely as the length of the wire. Thus you see how, by moving this bridge from point to point along the wire, we have it in our power to ascertain the comparative rapidity of the vibrations corresponding to the different notes in the scale.

I will now avail myself of this monochord to point out to you a curious property of vibrating strings which has a very important bearing upon the doctrine of musical Sounds. It is one with which violin players are familiar. By slightly touching the string at different points while I draw the bow across it, you see that it can be made to vibrate in two, or in three or more equal parts, sounding in succession the octave of the fundamental note, the fifth above the octave, the second octave, the major third above that again, &c. These are known as the first, second, third, &c., harmonics of the fundamental note.

Besides differences in pitch and intensity, musicians have long recognised another property characterizing musical notes, which they term *quality* or *timbre*. Two notes of the same pitch and intensity, sounded on a violin and an organ, are instantly recognized as different. In what does this difference consist? In other words, what is the *quality* of a tone? It is well known that a quick ear will detect in any note sounded, especially on certain instruments, not only the fundamental tone, but also several subsidiary higher tones identical with the harmonics which, you have seen, can, by suitable manipulation, be drawn from this monochord.

In these harmonics lies the solution of the problem of quality.

If we examine, as a physical problem, the vibrations of an instrument in which the ear can detect no harmonics—a tuning fork carefully sounded supplies us with an excellent instance—we find that these vibrations are exactly of the same character (though on a much smaller scale) as the motions to and fro of the bob of a common pendulum. We may term all such, then, pendulous vibrations.

Another consideration leads us to regard this as the elemental type of vibrations. It has been shown that all vibrations of whatever kind, if not themselves belonging to this simplest or pendulous type, can be regarded as made up of others which do.

It will probably appear obscure and perplexing that a vibration which, in one point of view is single, may thus in another aspect be regarded as composite. You will understand it more clearly on referring again to the monochord. Try the following instructive experiment: draw the bow across the string, and laying down the bow, take up a feather, and while the string is sounding damp it with the feather at the middle point. You will observe that the loud fundamental tone is replaced by a feebler, but still very perceptible octave or first harmonic. If, instead of damping the string at the centre point we damp it at one-third of its length from one end, you will hear not the octave but the fifth above the octave, or the second harmonic ring out.

Now, the act of damping the string has no power in itself to *produce* these higher notes. They must, therefore, have been part of the original tone. In other words, the string was not only vibrating as a whole, but in several parts. All these different modes of vibration must have been present in the movement of the string before it was disturbed, and thus we may convince ourselves, by experiment, of the fact, that a vibration, to all appearance single, may be resolved into a number of other more elementary vibrations.

The vibration of the air in an open pipe bears the closest analogy to that of a vibrating string. As the string, when disturbed, moves backwards and forwards, so when, owing to any cause, the air is heaped up in the centre of the pipe, it instantly tends to return to its normal state: the air springs back from the centre of the pipe, and the previous condensation is succeeded by a partial vacuum. To fill up this, the air rushes in again; and a panting is thus set up, which gives successive blows to the external air, and possesses that character of regular periodicity which is all that is essential to the production of a musical note.

[*The intermittent character of the movement of air in a sounding pipe was rendered visible to the eye by projecting the image of a singing flame on a revolving mirror.*]

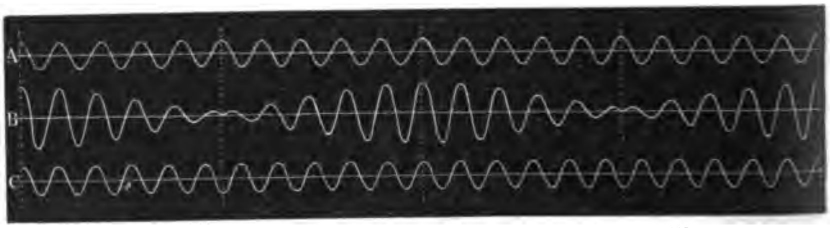
The longer the pipe, the slower are the pants, and the deeper is the note. As a string may vibrate in two or more parts, so may the air in the pipe; and, just as in the case of a string, such vibrations will generally be present, mixed with the fundamental vibration, which yields the proper note of the tube. We are now in a position to understand in what the *quality* of a musical note consists—simply in the proportion in which the harmonics are blended with the fundamental tone. Instruments in which the harmonics are very feeble—in which the fundamental tone is nearly unmixed—sound poor and thin. On the other hand, when the very high harmonics are present in considerable force, the sound is penetrating and shrill. The harmonics are, relatively, much stronger on stringed than on wind instruments. They vary very much, even on the same instrument, according to modifying circumstances. Take, for example, the piano. Here much will depend upon the way and place the string is struck—everything of the nature of abruptness tending to develope unduly the very high harmonics, which are better absent. Hence the care with which the hammers which strike the string are covered, so as to temper the suddenness of the blow; and hence, also, it is a matter of much importance in the construction to arrange that the hammer shall strike the string at the proper distance from the end. This can make no difference, of course, in the pitch of the note, but it sensibly affects the comparative strength of the harmonics. Accordingly, it is found that by placing the hammer so as to strike the wire about one-seventh to one-ninth of the whole length from the end, the most pleasing tone is obtained.

The most beautiful and interesting application of this theory of the bearing of the harmonics upon the *quality* of Sound is the explanation it affords of what it is that constitutes the difference between the vowel sounds of the human voice. Here we have an instrument exceeding all others in its powers of adaptation—one in which not only the pitch, but the quality of the note, can be altered at will. It can be shown that the distinction between the utterance of one vowel sound and another consists only in this, that each contains a different group of harmonics blended with the fundamental tone. The rationale of vowel sounds was first given by Sir Charles Wheatstone, and recently the subject has been reinvestigated most thoroughly by Prof. Helmholtz of Heidelberg.* The vocal organ belongs to the class of reed instruments. The air, when forced up by the lungs, is driven by pressure through a slit made by two vocal chords. The pitch of the note is determined by the tension of these vocal chords. The peculiar vowel character is given by the size and shape of the resonating cavity formed by the mouth and upper part of the throat. This we can change, from moment to moment, by the movement of the tongue and cheeks. The Sound, as it is emitted by the vocal chords, is full of harmonics; and the resonance of the cavity, according to its varying form, reinforces and intensifies some of these harmonics to the exclusion of the others, and thus determines which of the vowel sounds the note shall assume—whether an A, O, E, &c.

If this reasoning be accurate, and one vowel Sound only differ from another in the relative proportions of harmonics present in the tone, and if no essential element has been overlooked in the analysis, it follows that by artificially combining a system of pure notes to represent these harmonics we ought to be able to construct synthetically a vowel sound. Now this Helmholtz has succeeded in doing. He has arranged a series of tuning forks to correspond to a fundamental note and its harmonics, so that by means of electromagnets he can make such of them as he pleases sound with more or less intensity, and by mingling their notes in the due proportion, he has succeeded in reproducing with very tolerable accuracy all the principal vowel sounds.

Let us now proceed to examine what happens when the same medium is agitated at the same time by two different systems of waves.—For our present purpose we may limit our inquiry to the case in which the two systems of waves have nearly the same *period*, or in other words, in which the separate waves in both succeed each other at nearly the same intervals.

It will be simpler to investigate this matter in the case of transverse waves (such as those of water), as being more easily represented to the eye.



Let figures A and C represent two such systems. It will be seen on examining these figures, that they have been drawn in such a way that the intervals in (C) are a little shorter than those in (A), eleven undulations in the latter answering to ten in the former. Now suppose, that two systems of waves such as are here depicted, separately maintained by different causes, are passing independently over the same sheet of water, what will be the result?

---

* For this, as well as for his other researches in the Theory of Sound, see Helmholtz's most interesting work: "Die Lehre von den Tonempfindungen." A good French translation of it has been recently published.

The movement which will be produced by their combined action is given in (B).

It will be observed that the undulatory character is not lost; we have still a wave-movement, but a wave-movement with this important modification, that it undergoes a recurring fluctuation in intensity. At places where the crests of the two waves conspire [*represented in the figure by the first, third, and fifth dotted lines*], the water which would have been separately raised by each is doubly raised by their combined action, and we have a wave of twice the height of either. On the other hand, where the crest of one wave is overtaken by the trough of another [*represented in the figure by the second and fourth dotted lines*], the water which would have been raised as much by one as depressed by the other is consequently left undisturbed.

To apply this to the subject before us. We have a corresponding state of things brought about when two notes of equal force and very slightly differing in pitch are sounded together, only that for waves of water we must substitute successive pulses of the air. From what we have seen, it follows that the result is one system of waves of sound with recurring fluctuations, i. e. one musical note with recurring reinforcements and abatements in its intensity.

Such is the account of the phenomenon familiar to musicians that when two notes nearly in unison are sounded together a succession of beats is heard.

It is important to observe that the nearer the approximation to perfect unison the slower are the beats. [*The beats were here shown by means of organ pipes, tuning forks, &c.*]

These beats and the cause of their production have been long well known. Latterly they have, however, acquired additional importance. as Helmholtz has founded on them a solution of the very interesting problem—What is the physical cause of musical harmony and discord—why are certain combinations of notes pleasing and others painful to the ear?

His explanation is a very simple one. When two notes are almost exactly in unison we hear slow beats; as the interval is increased the beats quicken, till a point is reached when they become too rapid to be separately counted, but yet are plainly perceptible in the roughness or want of continuity they impart to the tone. It is this roughness which produces the jarring discordant effect upon the ear.

At first sight it would seem as if we could only thus account for the discord produced by two notes very close together in the musical scale, say differing by a semi-tone, and that we left other discords unexplained.

It is to be remembered, however, that we have shown that each musical note is accompanied by a suite of harmonics. In considering the result of the combined action of two such notes, we must not therefore confine our attention to the fundamental tones, which indeed may be so far apart that they may produce no beats to affect the ear, but have to consider all possible combinations of the fundamental and harmonics of the one with the fundamental and harmonics of the other.

For example, take two notes, differing by an interval half a tone less than that of a perfect fifth. Here the second harmonic of one, which, were the interval perfect, would precisely agree with the first harmonic of the other, as it is, does not coincide, but is just near enough to give rise to the roughness already mentioned.

Following out this train of thought, Helmholtz has drawn out a table of harmony and discord on the following principle. Applying his theory to the violin, he has calculated on a probable system of computation the amount of roughness due to the action of the beats for each interval in the musical scale, i. e. the amount of roughness which would arise from the interference of the fundamental tones with all their harmonics. The conclusions he thus arrives at *à priori*, as to the relative value in point of harmony of the different intervals, when compared with the verdict of the practical musician, show an accordance which leaves little doubt of the truth of the theory.

XLII.—*Account of a Natural History Excursion to the Continent, in the Spring of* 1869. By W. F. Kirby, Assistant in the Royal Dublin Society's Museum, and Member of several Entomological Societies.

[Read November 15, 1869.]

Having occasion to visit the Continent on business in May, 1869, I spent most of my leisure time in making collections for the Society; and the Council having kindly extended my leave of absence for the purpose, I was enabled to proceed as far as Switzerland, and make a small Alpine collection. I was not so successful as I had expected, owing to the very unfavourable season; but I was, nevertheless, able to make considerable additions to the Society's collection, principally in insects and reptiles.

Towards the end of April, I proceeded to London, where I took occasion to visit my friend, Mr. Hewitson, the celebrated Lepidopterist, by whose kind assistance I was enabled to name most of the undetermined butterflies in the Society's collection, which I had brought with me for the purpose. Several proved to be new or very rare; and, in return for one or two specimens which the Society had in duplicate, Mr. Hewitson gave me as many species new to the Society's collection as my boxes would hold—most of them rare. In

London, too, I took the opportunity of procuring such Entomological apparatus as I required to take with me to the Continent.

Before the 1st of May I reached Hilden, a small town about eight miles from Düsseldorf. Although too far north-west to be a very good locality for insects, it is one of the best in that neighbourhood. I know of the occurrence of fifty-eight species of butterflies within three miles of the town—nearly as many as are to be found in Britain, and just twenty more than are positively known to occur in Ireland. Nearly all these I have taken myself.

The town itself is situated on a flat plain, about two miles from the Rhine, and with large woods approaching in some places to within half a mile of the houses. Brooks and meadow-land are also to be found within easy reach; but the best localities are meadows more or less surrounded with wood. In some directions there are ranges of hills; but these are usually either highly cultivated or quite barren, and produce very few insects.

At the time I arrived there was not much to be found in the way of *Lepidoptera; Coleoptera* were more abundant; and I succeeded in obtaining many specimens of the beautiful golden green *Carabus auratus*, a very rare species in Britain, and possibly not truly indigenous. The edible frog (*Rana esculenta*) was abundant; it varies very much in colour, but is generally green, with brown spots. I obtained a fine series. The common frog was much more scarce; its numbers must be scarcely one to a hundred of the other. The sandy lizard (*Lacerta stirpium*) was common, and I succeeded in taking one specimen of the green lizard (*Lacerta viridis*), which I had hardly expected to find so far north. I looked a long time in vain for the tree-frog (*Hyla viridis*); but, ultimately, towards the end of May, succeeded in obtaining a fine series in the grass surrounding a pond. In the same pond I obtained a series of the two commonest kinds of newt (*Triton cristatus* and *punctatus*).

On June 1st I proceeded to Coblenz, and next day reached Heidelberg. The abundance of flowering Acacias beyond Mayence, already showed that some change in the vegetation was taking place. Just before reaching Heidelberg, I noticed an immense umbelliferous plant, which I never saw before, growing by the side of the railway.

As it was impossible to reach Lucerne in one day from Heidelberg conveniently, and I did not intend to remain in Basle, I preferred going on by a mid-day train next day, and seeing something of the neighbourhood in the morning.

I had not time to collect many insects; but what I got were very interesting, and as the weather afterwards proved so unfavourable in Switzerland, I much regretted not having stopped there longer. Among my captures was a specimen of the curious black, white-spotted moth, *Euplocamus Anthracinalis*.

The day was very fine, but hazy, and little could be seen of the magnificent view to the south. In the evening I proceeded to Basle. On one side of the railway rise the wooded mountains of the

Black Forest, and on the other is the flat plain of the Rhine, with the summits of the Vosges mountains rising behind it for part of the distance.

It looked rather strange to see fruit trees growing everywhere among the corn, as is the custom in Baden. On the 4th of June I reached Lucerne, and next day made the ascent of the Rigi. I found a good many interesting insects, but not as many as I had expected; nevertheless, it was one of the best day's collecting I got in Switzerland. I made the ascent from Wäggis by the easiest, and I imagine the most picturesque route. Among the most interesting insects observed were the strange-looking Neuroptorous insect (*Ascalaphus macaronius*), with very long antennæ, clubbed at the tip, like those of a butterfly; and the beautiful sub-Alpine butterfly (*Parnassius Apollo*), which was flying among *Pieris Cratægi*, and was not easily distinguishable from it on the wing at a little distance.

With the sunrise on the Rigi I was disappointed; and, indeed, it is said to be only seen in perfection on comparatively rare occasions. On descending the mountain I was unfortunately advised to go round by Rigi-Scheideck, one of the lower peaks; but the views, although fine in places, were not particularly striking; and that portion of the mountain appears to be almost barren as regards Entomology. The only captures of importance made on the road were some more specimens of the fine *Ascalaphus* already mentioned, which flies round the fir-trees, and looks very singular on the wing.

On the 7th I proceeded to Hergiswyl, at the foot of Mount Pilatus, which I judged would be a better locality than the Rigi, as it is known to be very rich in plants. The same day I went out to reconnoitre near the village, and met with a few insects, but with nothing of great interest.

Next day I made the ascent of Pilatus; but the insects were later there than in the sheltered ravine above Wäggis, and I did not meet with anything very remarkable. The mountain is, however, much more worth the ascent than the Rigi; the views are much finer, and though it is a thousand feet higher, and the ascent is steeper, it is shorter and less fatiguing than the other. There was a great deal of snow still lying in places near the top of the mountain; and the road to the highest peak was still blocked up with it. The second peak is, however, considered to have the finest view of the two; and this I ascended. This peak goes by the absurd name of "The Donkey," for what reason I have not heard.

On returning to Hergiswyl in the evening, I met several parties of tourists ascending; but the evening set in very wet, and the next day being very dull, I determined to go further south, as I had not been much pleased with my success in the neighbourhood of Lucerne. On the 9th, therefore, I proceeded to Altdorf, at the entrance to the Pass of St. Gothard, and celebrated above all towns in Switerland from its connexion with William Tell, whose colossal statue stands in the market-place, on the spot where he stood to shoot the arrow. It is a little primitive town; and I think that on another occasion I would rather choose to stay there than at Lucerne; for the immediate neighbourhood of a large town is seldom a good halting-place for a Naturalist.

Next day I set out for the St. Gothard. The weather was gloomy and threatening, and very unfavourable for collecting. Soon after leaving Altdorf, a specimen of ***Alytes obstetricans*** came hopping across the road, and was secured. This animal is something between a toad and a frog, and is remarkable for the habit of the male, who carries the eggs about till they are nearly ready to be hatched. After passing the town of Amsteg, the mountains begin to close round, and the Reuss comes thundering down along the valley below the road, and forming one course of rapids as far as Andermatt.

After passing Amsteg, several interesting insects were met with; among others, a *Cicada,* the first I had ever seen alive; and a very pretty orange-yellow moth, with black streaks and spots (*Setina Ramosa*). Of the latter, I secured a fine series.

At a height of perhaps three thousand feet, ***Triton Alpestris*** occurred commonly in puddles by the side of the road. When approaching Andermatt, it began to rain heavily, and I should have stopped at Geschenen, had I not mistaken the bridge at that village for the Devil's Bridge, and thought that Andermatt was close beyond. I was very glad when, after passing the real Devil's Bridge, and going through a short tunnel, the valley of Andermatt opened before me. It is, however, only the contrast that makes that valley interesting; or, perhaps, I saw it under unfavourable circumstances. There is little to be seen in it but short grass and marsh-mallows.

The elevation of the valley is comparatively slight; but I felt the cold much more than I did afterwards at a much greater elevation.

Next day (the 11th), I walked over the Pass. Snow-drifts higher than my head were on both sides of the road; all the rivers flowed out of miniature glaciers; and the top of the Pass is a dreary frozen marsh. I was told that the Furka Pass was still blocked up, and inaccessible. Few insects were met with on that day. The grassy slopes covered with rhododendrons, above the town of Airolo, must be very good for collecting in fine weather; but there was a freezing wind blowing over them which I had not expected on the south slopes of the Alps, and at so low an elevation (under four thousand feet), which carried every insect seen out of reach before it could be captured.

On reaching Airolo, I took the diligence to Bellinzona. The following day was fine; but wishing to reach Lugano, which I had fixed upon as the ultimate point of my excursion, I went on. However, Lugano is surrounded by vineyards, and but little was to be found either on the road or in the immediate neighbourhood of the town. I intended to have gone further out of town next day; but the weather proved so very unfavourable again that I determined to go round to the Upper Engadine, in the Grisons, one of the best localities for insects in Switzerland. It is scarcely possible that the Canton Ticino, which is almost unexplored by naturalists, should not be extremely rich in insects, as it extends further south than any other part of Switzerland, and lies between the two richest cantons of all, in Entomological respects, Grisons and Valais; but I had no chance of examining its capabilities. I therefore proceeded to Porlezza by steam-boat, over Lake Lugano, and crossed over to Menaggio, on Lake Como, taking the boat again to Colico, and diligence to Chiavenna.

The most remarkable plant I noticed in this neighbourhood was the orange-red lily, which grows here in gardens. I had previously noticed it at intervals on the rocks along the Val Levantina. The day was extremely dull, and beyond the beautiful clearness of the atmosphere, even in such weather, the narrow streets, and the dirt and laziness of the peasantry in the villages, there was little to show that I was in Italy at all.

On the 14th I went on from Chiavenna to Samaden. It was a Scotch mist all day, ending in rain. Early next morning I proceeded to Pontresina; but it soon began to rain, and afterwards to snow heavily. In the afternoon it cleared up, and I took a walk; but I saw no insects, nor did I expect to meet with any. The following day was fine, and the snow was fast melting, and I went a walk to the Val da Fain, where most Entomologists who have visited it say they saw insects, and especially butterflies, swarming in such abundance as they could never have imagined possible. I got a few specimens of two or three good butterflies, such as *Pieris callidie* and *Erebia manto;* but they were not very common, and the most abundant insects were the little black mountain moths (the *Hercynæ*), which were swarming like flies. Still this was not encouraging, and next day I left Pontresina, going over the Albula Pass to Coire. At the entrance of the Pass the pretty little black and orange moth (*Psodos alpinata*) was abundant. I much regretted afterwards that I did not walk, as alpine butterflies, many of them desiderata to the collection, were common, and though I secured several good species *Argynnis Pales*, and *Polyommatus pheretes*, and *Orbitulus* for instance, if I had taken two days to walk, instead of one to ride, I could easily have obtained many more.

From Coire I returned to Lucerne, *via* Zurich. In Zurich and Lucerne I succeeded in purchasing a few specimens of small mammals and birds for the Society's collection; and at Zurich I made the acquaintance of the celebrated Swiss Entomologist, Professor Frey.

I had intended to have revisited Hergiswyl for the purpose of collecting, but the weather continued so unfavourable that it was useless to attempt to do anything more; and therefore I went on to Mannheim by rail, and then down the Rhine again to Cologne, and so back to Hilden.

At Hilden I found several insects that I wanted which had appeared during my absence, especially the Evergreen Oak Hair-streak butterfly, *Thecla Ilicis*.

After staying there a few days, I returned to London, and in London I purchased a few reptiles which I had not succeeded in obtaining myself; and selected a number of foreign Lepidoptera, desiderata to the collection by Dr. Carte, which were subsequently ordered.

I had been far from satisfied with the results of my expedition; but when I came to arrange and look over my collections in Dublin, I found much more than I had expected. The following is a summary of my entire collection :—

REPORT ON THE COLLECTION.

SPECIMENS COLLECTED.				SPECIMENS PURCHASED OR EXCHANGED.			
	Specimens.	Species.	New to collection.		Specimens.	Species.	New to collection.
Mammals, . .	1	1	1	Mammals, . .	4	4	4
Reptiles, . .	85	11	7	Birds, . . .	2	2	2
Lepidoptera, .	660	196	54	Reptiles, . . .	11	4	2
Neuroptera, .	32	18	11	Insecta, . . .	133	125	125
Coleoptera, &c.	382	136	44				
	1160	362	117		150	135	133

Total number of specimens obtained, ...	1310
„ species „	497
„ „ new to the collection, .	250

A full list of the species collected by Mr. Kirby is appended to the paper, as far as there has been time to identify them correctly.

LIST OF ANIMALS AND INSECTS COLLECTED BY MR. KIRBY.

NOTE.—In order to complete the local Fauna of Hilden as far as possible as regards the Butterflies, a few species are added which were collected on former occasions; but these are distinguished from those collected in 1869, by being placed between brackets.

MAMMALIA.

Arvicola arvalis, Pilatus.

REPTILIA.

Rana temporaria,
„ esculenta, } Hilden.
Hyla viridis,
Alytes obstetricans, Altdorf.
Triton cristatus, } Hilden.
„ nctatus,
„ alpestris, St. Gothard.
Lacerta vivipara, Rigi.
„ stripium, } Hilden.
„ viridis,
„ muralis, Val da Fain.

LEPIDOPTERA.

Papilio Machaon, Hilden, Albula.
P. Podalirius, Rigi.
Parnassius Apollo, Rigi.
Pieris brassicæ [Hilden], Bellinzona.
„ cratægi, Hilden, Switzerland.
„ [rapæ, Hilden.]
„ napi, Hilden, Albula.
„ „ var. Bryoniæ, Switzerland.
„ Callidice, Val da Fain, Albula.
[Pieris Daplidice, Hilden.]
Anthocharis cardamines, Hilden, Switzerland.
Leucophasia sinapis, [Hilden], Switzerland.

Colias Edusa, } [Hilden], Switzerland.
„ Hyale,
Melitæa Artemis, [Hilden], Rigi.
„ Cinxia, Hilden, Rigi.
„ didyma, Rigi.
„ Athalia, } Hilden, Switzerland.
„ Dictynna,
Argynnis Euphrosyne, } Hilden, Switzerland.
„ Selene,
„ Pales, Albula.
„ Aglaia, Hilden.
„ [paphia, Hilden].
„ [Lathonia, Hilden].
[Araschnia Prorsa, Eller, near Hilden].
[Grapta C. album, Hilden].
[Vanessa polychloros, Hilden].
„ [urticæ, Hilden].
„ [Io, Hilden].
„ [Antiopa, Hilden].
[Pyrameis Atalanta, Hilden].
„ [cardui, Hilden].
Limenitis Sibylla, Hilden.
[Apatura Iris, Hilden].
Melanargia Galathea, Hilden.
„ var. Lugano.
[Satyrus Ægeria, Hilden].
„ Megæra, Hilden, Switzerland.
„ Mæra, } Switzerland.
„ Hiera,
[Hipparchia Semele, Hilden].
Epinephile janira, Hilden, Bellinzona.
„ [Tithonus, } Hilden.
„ [Hyperanthus,
[Cœnonympha Pamphilus, } Hilden.
[„ Typhon,
„ Arcanius, Heidelberg.
Maniola melampus, Albula.
„ Medusa, Rigi.
„ Manto, Val da Fain, Albula.
„ pirene, Rigi, St. Gothard, Albula.
„ evias, Albula.
Nemeobius Lucina [Neanderthal, near Hilden], Rigi, Pilatus.
Cupido rubi, } Hilden.
„ ilicis,
„ pruni,
[Thecla betulæ, Hilden.
„ [quercus, Hilden].
Lycæna Circe, Hilden, Rigi.
„ phlæas [Hilden], Pilatus.
Polyommatus pheretes, } Albula.
„ orbitulus,
„ Icarus, Hilden, &c.
„ Adonis [Hilden], Switzerland.
„ Arion, Pilatus.
„ semiargus [Hilden], Switzerland.
Polyommatus alsus, Switzerland.
„ alcon, Rigi.
„ Argus, Hilden, Switzerland.
„ calliopis, Lugano.
Pyrgus malvæ, Hilden, Switzerland.
„ var, Hilden, Rigi.
„ sao, Rigi.
„ alveus, Albula.
Nisoniades Tages, Hilden, Switzerland.
Pamphila sylvanus, } Hilden.
„ linea,
„ [comma], } Hilden.
„ [lineola],
Heteropterus Paniscus, Heidelberg.
Macroglossa bombyliformis, Switzerland.
Anceryx pinastri, Hilden.
Sphecia apiformis, } Hilden.
Zygæna trifolii,
„ filipendulæ, Lugano.

[Note.—*Z. Filipendulæ*, usually common everywhere, is very rare at Hilden, and is said not to occur at Barmen.]

Ino statices, Hilden.
Setina ramosa, Amstäg, Bergell.
Callimorpha Jacobææ, Hilden.
Nemeophila Plantaginis, Heidelberg.
Spilosoma menthastri,
Euproctis Auriflua,
Stilpnotia salicis,
Lymantria dispar,
Cerura bifida,
„ vinula,
Pheosia dictæa,
Odenestis potatoria,
Lasiocampa rubi,
Clisiocampa neustria,
Diphtera Orion,
Acronyeta psi,
„ leporina,
„ aceris,
„ ligustri, } Hilden.
„ megacephala,
Leucania pallens,
Xylophasia polyodon,
Agrotis exclamationis,
Triphæna pronuba,
Graphiphora C. nigrum,
Ipimorpha subtusa,
Dianthæcia conspersa,
Eurois nebulosa,
Haden chenopodii,
„ dentina,
Panemeria arbuti,
Agrophila sulphuralia,
Erastria fuscula,

Catocala nupta, } Hilden.
Euclidia mi, }
,, glyphica, Hilden, Switzerland.
Phytometra ænea, Hilden.
Rivula sericealis, Lugano.
Hercyna, 2 or 3 species, Switzerland.
Pyransta purpuralis, Hilden, Switzerland.
,, porphyralis, Albula.
Ennychia cingulalis, Pilatus.
Diasemia litteralis, Hilden, Hergiswyl.
Botys verticalis, Lugano.
,, alpinalis, Hergiswyl.
Scopula lutealis, Albula.
Venilia maculata, Hilden.
Ellopia fasciaria, Hilden.
Selenia lunaria, Hergiswyl.
Boarmia, Tephrosia, &c., several species, Hilden, &c.
Torula alpinata, Albula.
Pseudoterpna cytisaria, } Hilden.
Nemoria viridata, }
Iodis lactearia, Heidelberg, Pilatus.
Ephyra punctaria, } Hilden.
,, orbicularia, }
Acidalia ochrata, Rigi.
,, ornata, Hergiswyl.
,, 3 or 4 other species from Hilden, &c.
Cabera pusaria, Pilatus.
,, exanthemaria, Hilden.
Corycia taminata, } Heidelberg.
Macaria notata, }
,, liturata, } Hilden.
Halia wavaria, }
Strenia clathrata, Hilden, Pilatus.
Fidonia atomaria, Hilden, Switzerland.
Bupalus piniarius, Hilden.
Scoria dealbata, Pilatus.
Lythria plumularia, Pontresina.
Abraxas grossulariata, Hilden.
Lomaspilis marginata, Lugano.
Larentia pectinitaria, Hilden.
Melanthia ocellata, Hilden.
,, albicillaria, Hilden, Rigi.
Melanippe hastata, Heidelberg.
,, galiata, Hilden.
Coremia ferrugaria, } Hilden.
Camptogramma bilineata, }
Tanagra chærophyllata, Hergiswyl.
Crambus, 6 species, Hilden and Switzerland.
Tortrices, &c. 18 species, including,
Xanthosetia hamana, } Hilden.
Tortrix viridana, }
Euplocamus anthracinalis, Heidelberg.
Harpella Geoffroyella, Hilden.

ORTHOPTERA GENUINA.

Acheta Campestris, Hilden.
Gryllotalpa vulgaris, Lugano.
Locustidæ, various.

ORTHOPTERA PSEUDONEUROPTERA.

Libellula depressa, Hilden.
,, striolata, Lugano.
Æschna pratensis, }
Calepteryx virgo, } Hilden.
Agrion minium, }
Ephemera vulgata, }

NEUROPTERA.

Panorpa montana, Rigi, Pilatus.
,, communis, Albula.
Phryganidæ, 6 species.
Sialis lutarius, Hilden.
Ascalaphus coccajus? Rigi.

COLEOPTERA.

The letters S. and H. denote Hilden and Switzerland. Species not marked occurred in both localities.

Cicindela campestris.
,, sylvatica, H.
,, sylvicola, S.
,, gallica, S.
Carabus cancellatus, H.
,, Ulrichi, S.
,, auratus.
,, intricatus, S.
Pristonychus terricola, H.
Anchomenus 6-punctatus, H.
Pterostichus parumpunctatus, S.
,, melanarius, H.
Zabrus piger, H.
Amara fulva, H.
Harpalus rufescens, H.
,, honestus, H.
Ilybius uliginosus, H.
,, fenestratus, H.
Agabus maculatus, H.
Gyrinus natator, H.
Creophilus maxillosus, H.
Emus hirtus, Rigi.
Necrophorus mortuorum, S.
Hydrophilus caraboides, H.
Cetonia aurata, H., Heidelberg.
Phyllopertha horticola, H.
(Goes by the popular name of "Buck-Wheat Beetle" in Germany).
Aphodius fossor, H.
Lucanus cervus, H.

Lampyris noctiluca, H.
„ splendidula, H.
Trichodes apiarius, H.
Blaps similis, H.
Melandrya caraboides, H.
Lytta vesicatoria, H.
Hylobius abietis, H.
Aromia moschata, H.
Clytus arietis, H.
Lamia tristis.
Liopus nebulosus, H.
Saperda carcharias, H.
Rhagium inquisitor, S.
„ bifasciatum, S.
Pachyta 8 maculata, S.
Strangalia pubescens, H.
Leptura livida, H.
Grammoptera lævis, S.
Clythra læviuscula, S.
Cryptocephalus aureolus, H.
Timarcha coriaria, H.
Chrysomela sanguinolenta, H.
„ hæmoptera, H.
Lina ænea, S.
„ tremulæ, S.
„ populi.
Gastrophysa polygoni, H.
Coccinella 7-punctata, H.
„ 14-punctata.

HYMENOPTERA.

(Kindly determined by Mr. F. Smith, of the British Museum).

Rhyssa persuasoria, St. Gothard.
Cryptus cyanator, Hilden.
Bombus Italicus, Lugano.
Apathus rupestris, Heidelberg.
Chalicodoma muraria, Hergiswyl.
Vespa crabro, Hilden, Hergiswyl.
Polistes diadema and nests, Lugano.
Formica herculanea, Heidelberg, Hergiswyl.
Myrmica rubra,
Pachyprotarsis rapæ, } Switzerland.

MYRIAPODA.

Lithobius forficatus, Hilden.

The collections of Hemiptera, Diptera, Arachnida, &c., are mostly undetermined at present.

XLIII.—*On a recently observed Meteor.* By HOWARD GRUBB, C. E.

[Read November 15, 1869].

I MUST first make an apology for the introduction of a communication not mentioned in the printed list of business for this evening; but as the subject of this communication did not make its appearance until after our Committee Meeting, at which the business of these Evening Meetings is decided on, the impossibility of putting it on the list will, I hope, be sufficient apology, particularly as I shall require but a very few minutes to communcate all I at present know of this remarkable meteor. I shall first state the results of my own observation.

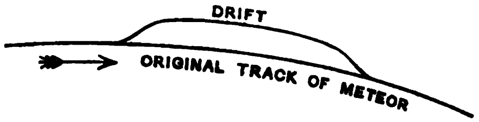
Walking down the Rathmines Road with a friend on the evening of the 6th instant, having left Leinster Road in good time to meet the 7 P. M. train at Westland-row, at two or three minutes before 6½ P. M., as nearly as I could say, we were both startled by a bright light that suddenly illuminated the whole sky over town before us, and distinctly lit up all details of the houses in Richmond-street, some quarter of a mile distant. Conceiving it to be some fine rocket discharged over our heads, or behind us, I turned quickly round, and saw what I instantly recognized as a very splendid meteor, the largest and brightest I ever saw. It had nearly finished its course when I saw it, and to *me* appeared to simply diminish in intensity, and disappear without any bursting or falling asunder, as some others describe. I am not versed in Pyrotechny; but I dare say most here will understand me when I compare it to a particular kind of rocket (whose proper appellation I am not aware of), which rises generally in a gracefully curved line, as a bright star, with a brilliant train; the star disappearing in an unsatisfactory kind of way, and leaving the train visible for a considerable time, and often blown in one direction or another by the wind. This was exactly the appearance the meteor had to me; but I am quite sure it had much diminished in intensity when I saw it, as the effect on the sky and houses had nearly disappeared by the time I had turned round; but it was, nevertheless, the most splendid sight I ever saw in the heavens.

After looking at the train it left behind it for a few seconds, I began to regret I had not counted the seconds, as I have once or twice before seen the trains of meteors remain for 5″ or 10″; but a very few more seconds showed me that this train would be more persistent, so I took out my watch, and we agreed to allow 15″ for lost time.

From the same spot we watched it for four minutes, without perceiving any sensible diminution in its brilliancy. We then walked on, watching the train constantly.

Before leaving the spot, however, I roughly took the bearings of the train by terrestrial objects, and took an early opportunity afterwards of verifying its celestial position. I found the train extended fully 20° in a nearly horizontal line, commencing at Right Ascension—22h. 40m.; Dec$^{\text{n}}$ South, 12°; ending Right Ascension—21h. 15m.; Dec$^{\text{n}}$ South, 17°; or commencing at 15° E. of S., 25° altitude; and ending at 5° W. of S., 20 altitude.

About five minutes after the meteor had disappeared we distinctly, saw a portion of the train drifting away as it were from the rest, thus:—



Also we saw something like a dark cloud along the line of train, the rest of the sky being clear; but this I could not place much reliance on, as our position among the lamplight prevented us seeing such an object as distinctly as we could have done in a more favourable position. The train itself we saw distinctly for eleven minutes; but here also the lamplight partially foiled us, for some friends outside town were able to see it for fifteen minutes.

I awaited some days in the expectation of seeing some notice of it in the papers here; but not seeing any such, and hearing several accounts from England, I sent a short letter to the "Express," and called upon persons who had seen it to send in the results of their observations, that by comparison we might come to some satisfactory conclusion as to its position, altitude, &c., and, perhaps, add some slight quota to our present knowledge of the bodies.

I shall now shortly give the results of the comparison of seven observations, viz.:—Dublin, Galway, Bandon, Shropshire, Dorset, and two at Bristol. The observations agree wonderfully well, considering the rough means at hand for estimating the quantities:—

1st. As to position on the earth's surface.—The mean of all observations gives about 20 miles off the extreme point of Cornwall or Land's End for the disappearance of the meteor; no observation being more than 25 miles wide of this, although some were taken 250 miles away. But I am bound to say that my own observation would show it to have been some 20 miles further to sea; and from some other elements of the several observations, such as altitude, &c., I am inclined to think that the true point will be found to be at least 30 miles S. W. of Land's End.

2nd. Altitude.—The mean of five observations gives 67 miles, while mine alone gives 80. Most of these altitudes were guessed quite roughly, and on that account, and from the fact of mine being the only observation (apparently) where measures were attempted, I am inclined to give more weight to it; and I would, therefore, say for the probable altitude 75 miles.

3rd. Length of train.—A mean of five observations gives 77 miles, which is just two miles more than my measurement, and probably very near the truth.

4th. Direction of Train.—Accounts from the South of England state the direction to have been nearly vertical; from Shropshire a diagonal line *descending* from E. to W.; Dublin nearly horizontal; and Galway rising from E. to W. These observations, taken in connexion with their relative positions, would give a direction of 60° W. of S. and nearly parallel to the earth's surface.

5th. Velocity.—The mean of most observations of time is about 2″, and this gives a velocity relative to the earth of about 138,600 miles an hour. I have not as yet calculated its actual velocity in space.

I should hope that we may receive more accounts of this remarkable meteor, as, owing to its great brilliancy and unique characteristics, it could not possibly escape identification; but I have thought it well to bring the matter before the Dublin Society without any delay, in the hope that it may induce inquiries, and lead to some further information.

XLIV.—*Botanical and Horticultural Notes made when passing through Portions of Belgium, Prussia, and Russia, to the Botanical Congress and International Horticultural Exhibition, held at St. Petersburgh, May* 19, 1869. By D. Moore, Ph. D., &c.

[Read December 20, 1869.]

LONDON TO HANOVER AND BERLIN.

The English party left London on the evening of the 7th of May, and reached Belgium, *via* Ostend. We made no stay, farther then the usual halts at stations, until Hanover was reached, where several of the party remained one day, for the purpose of seeing the fine collection of Palms and other plants in the Botanical Gardens at Herrenhausen.

We were fortunate to meet at once in the garden Mr. Wendland, the Inspector, who, with his well-known kindness and affability, paid us every attention in his power, though he too was preparing to go to St. Petersburgh. The collection of Palms, for which this establishment has long been famous, has been greatly increased of late years, and the individual plants have in many instances attained a large size.

Among them is the finest plant in Europe of the Australian Fan Palm (*Corypha australis*), which alone is almost worth a journey from England to see. When there I was invited by Mr. Wendland to make a list of *desiderata* for Glasnevin, which I did, and the plants selected have since been received.

Some of the ornamental trees in the extensive park at Herrenhausen, and those planted through the suburbs of the town, were very effective at the time of our visit, particularly the fine Scarlet Horse Chestnuts, double-flowering Cherries, purple and copper-leaved Beech—all of which are grown there in quantities. In the woods we noticed the Lily of the Valley, *Convallaria majalis*, and *Smilacina borealis* growing in great abundance wild, the flowers of which the children were gathering in handfuls, in like manner as children here gather the flowers of the cowslip and wood violet.

Leaving Hanover, we next reached Berlin, where we met many friends from Western Europe, journeying to St. Petersburgh. On the evening after we arrived, we went to see some of the best private collections of plants near the city. That of Herr Borsig's is well known to all lovers of plants, and has been long famed for the extent and fine examples of many rare kinds of them.

The culture of Orchids is made a specialty there, and they are grown with much success. The houses used for this purpose are low span-roofed structures, with good arrangements for airing and for shading in summer. In one of the cool conservatories we saw an excellent plan for showing off plants to good effect when in flower. The floor was laid out in figures, each separate bed covered with some easily-grown plant, among which the pots were sunk in the earth to their brims, and only the flowering portion of the plant seen above the surface. For example, one of the beds was covered over with *Selaginella denticulata*, with finely-flowered white and pink Azaleas placed through it. The contrast of the flowering plants on the deep-green surface had a charming effect. Fresh relays of plants are kept ready to replace others as they get out of bloom.

On the following day we visited the Botanical Garden, which has long held a first place among the principal Botanical Gardens of Europe. In number of species it is exceedingly rich, many of which are very rare, and some fine examples among them. Nearly all the families of plants which have been introduced to Europe are well represented in that establishment.

Professor Braun and Herr Bouché, Inspector of the Garden, accompanied us, and pointed out some of the most interesting plants. In the Palm House we noticed fine specimens of the following kinds—namely, *Oreodoxia sanchona*, *Penanga costata* and *Penanga coronata*, *Iriartea præmorsa*, *Tetrinax aculeata*, *Diplothemium caudescens*, *Œnocarpus gracilis*, *Desmonchus resinifera*, &c. &c.

Among other things, Professor Braun pointed out to us the curious parasitical *Lathræa clandestina*, which was then in flower in the open ground.

At Potsdam, a portion of the English party visited the New Palace Gardens, which is the residence of the Crown Prince and Princess of Prussia. The Princess Royal, and Princess Alice of Hesse, the latter of whom was then on a visit at Potsdam, on hearing we were there, honoured us with a brief interview. The former made mention of her recollection of visiting the Glasnevin Botanic Garden, and also of the pleasure she felt on seeing the luxuriant vegetation of ferns, &c., at Killarney.

BERLIN TO ST. PETERSBURGH.

After leaving Berlin we went on direct to St. Petersburgh, without halting at any of the intermediate stations longer than the usual railway stops for refreshments, &c.

On reaching the Russian capital, we were met by some members of the *Comité de Reception des Etrangers*, who assisted us to get to our lodgings, and any other matters which we required them to aid us in.

INTERNATIONAL EXHIBITION AT ST. PETERSBURGH.

On the following day, 16th May, the International Exhibition was opened by a religious service in accordance with the Greek Church, by the Archbishop or High Priest of St. Petersburgh, which was solemn, imposing, and quite new in form to us strangers from the west. No instrumental music was used at this nor at any other of the religious services at which we were present in the Russian churches After the conclusion, the Emperor and suite were conducted through the Exhibition, and the principal plants pointed out to them, when it was declared by him opened. The plants were arranged in a vast structure called the manége Michel, which is used as a riding school and for cavalry exercising in during winter. It is 539 feet long, by 119 wide. The masses of plants brought together on that occasion were arranged in large groups, standing on the ground on both sides of a wide artificial winding passage, leading from one end of the vast building to the other. Dr. Regel, Director of the Botanic Garden, who had the principal management of this department, showed from the manner he had the plants placed that well he understood how to produce effect with the conspicuous kinds of Palms, &c. About the centre of the building were artificial waterfalls, and a small lake, with aquatic plants standing in it and around it. Rising from this, an artificial mound was raised, on the summit of which a pretty Russian Kiosque was built, from which a kind of bird's-eye view of the whole Exhibition on each side was obtained. Another very effective feature was at the entrance, where a wide stair led to a broad platform, raised at such an elevation as enabled visitors to get a tolerably good view of the whole mass of plants and people together, nearly from one end of the long building to the other. The more tender plants were exhibited in a glazed conservatory, heated for the purpose, adjoining the great building.

It was interesting to see the groups of plants from so many parts of Europe, and to compare Eastern culture with that of Western countries.

Palms, Camellias, and Roses were exhibited in considerable quantities from Russian gardens, but more especially Roses, which were remarkably fine, both as to cultivation and kinds, at that early period of the season. Vegetation at St. Petersburgh is fully six weeks or more later than it is in England. The period at which the Exhibition was held, 20th May, might be compared with the end of March or beginning of April in Ireland. We felt a good deal interested in one group of terrestrial European Orchids, which were exhibited in full bloom, among which were *Cypripedium macranthum*, *Cypripedium calceolus*, *Orchis militaris*, *Orchis morio*, *Orchis pallida*, *Orchis fusca*, *Orchis sambucina*, *Orchis mascula*, *Liparis foliosa*, *Microstylis diphyllis*, *Malaxis monophyllis*, *Ophrys tephrosanthus*, *Ophrys aranifera*, and *Ophrys myodes*. They were all good plants, and not drawn up by being forced into flower.

Nearly all the exotic Orchids came from England, of which Mr. R. Warner had a magnificent collection. Every one there was astonished at their freshness and at the perfection of their inflorescence, after so long a journey as they had undergone.

Among foreigners, the Belgians were the largest exhibitors, particularly M. Linden, of Brussels; M. Verchaffelt, of Ghent, whose exhibits were numerous and general, consisting of fine Palms, Tree Ferns, Dracænas, Azaleas, &c., &c. The Messrs. Veitch, of London, exhibited some valuable plants of recent introduction to Europe.

The Exhibition remained open eight days, and was numerously attended by many members of the Royal Family, the *elite* of Russian society, and the public generally.

BOTANICAL CONGRESS.

The International Congress of Botanists and Horticulturists held their first meeting on the 19th May, under the presidency of General Greig, Aide-de-camp to the Emperor, and President of the Horticultural Society of Russia. The meeting was in a large chamber belonging to the Admiralty; twelve Vice-Presidents and twelve Secretaries aiding the President. Among the papers read at the different *seances* were the following:—One on the physical and chemical effects produced by light on plants, by Professor Morren, of Liège, which led to a long discussion; another, on the amelioration of races of cultivated plants, which also gave rise to a lengthened discussion. M. Orphanides, Professor of Botany at Athens, gave some account of the Flora of Greece, and expatiated on the influence which the culture of plants exercised on the manners of the inhabitants of countries. Also, the results of his observations respecting plants known and mentioned by the ancients. Professor Willkomm, Professor of Botany at Dorpat, read a paper on the circulation of sap in plants. The discussions which followed on the reading of these and others were fraught with interesting matter.

EXCURSIONS NEAR ST. PETERSBURGH.

During the week we remained at St. Petersburgh excursions were arranged for each day, to places of interest in the city and suburbs, which enabled strangers to see a good deal of the country, as well as to partake of the hospitality the Russians had prepared for us. One of the most important of those excursions was that to Tsarköe-Selo, formerly the summer residence of the Emperor Alexander II., and now the favourite country residence of the present Imperial Family. It is about twenty-two versts from St. Petersburgh, close to the South-Western line of railway, by which it is easily reached. The magnificent palace of Tsarköe-Selo was commenced in the reign of the Empress Catherine, and finished by her successor. The gardens, parks, and pleasure grounds attached thereto are very extensive, and, consequently, very little of them could have been seen during our brief visit, only for the admirable arrangements which were made. On alighting at the railway station, there were a sufficient number of open and other carriages waiting to convey all the numerous party to the most interesting spots, under proper guides. The ranges of conservatories in the Imperial Gardens for the growth of plants and culture of fruit are exteriorly very plain, and have evidently been built with more regard to the nature of the climate than for ornament. In a country where the temperature occasionally falls so low as 40° of Centigrade below freezing = 40° below zero Fahrenheit, it is necessary to be able to protect tender plants by other means than ordinary glazed conservatories, even though supplied with powerful heating apparatus. During the extreme colds in winter, the roofs of the conservatories there have to be covered over with boards, laid on thick layers of straw or hay, to prevent the frost from entering to their interiors; for example, we observed that nearly all our hardiest trees and shrubs, including most of our coniferous species, are cultivated in pots and tubs in the conservatories. Our common Lauristinus was pointed out to me in flower, as being a plant worthy of noticing specially. Large quantities of Laurels, Sweet Bays, Aucubas, and Arbutus, are grown in the orangeries for decorating the saloons on great fete days. In other divisions of the range we saw many very good and highly-ornamental plants, including Palms, Dracænas, Pandanas, Azaleas, Ferns, &c., &c., which it must be difficult to keep in health during the long winters there. The vineries, peach houses, and pine stoves were all filled with the different kinds of trees and plants cultivated there, similar to those of same sorts in our best English gardens. The extensive pleasure grounds surrounding the Palace of Tsarköe-Selo have been formerly laid out with a very considerable degree of taste, a good deal after what is called among English and foreign landscape gardeners the English style; but the varieties of trees available for that purpose in Russia are not nearly so numerous as with us. Lime trees, Elms of different kinds, Poplars, Birch, Willows, and a few of the hardier kinds of Pines were the principal trees we observed in the parks. The attention of the visitors who were interested in arboriculture was specially directed to some grand examples of the Siberian Pine, *Pinus pichta*, which in Russia attains a height of from seventy to eighty feet. In open glades through the parks we observed quantities of *Trollius europeus* growing wild and in full flower. Also the rare *Anemone ranunculoides*, which is yet so scarce in our best British collections, was growing in large patches among the grass and under the trees. The farm and dairy of the Emperor were also visited, where a considerable number of the domesticated animals found in different parts of the Russian dominions are kept. On arriving at the Palace, the Vice-Presidents and Secretaries of the Congress, along with some members of the jury, were presented to the Emperor, before partaking of a *dejeuner* on a grand scale, which was prepared for all the party present.

On the following day, 20th May, the strangers were invited to visit the Imperial Botanic Garden at St. Petersburgh, which is situated on one of the islands in the Neva, called Apothecary's Island. A steamboat was appointed for the purpose of taking the party up the river, which was very enjoyable, the day being fine and warm, and the country looking in full blush of spring. The surface of the ground where the Botanic Garden is situated is flat, and not very picturesque, excepting that portion which skirts the banks of the river; but the extensive ranges of conservatories, containing one of the richest collections of plants in Europe, render a visit to this celebrated establishment a circumstance of no ordinary interest to those who are acquainted with botany and plant culture.

The large Palm House is a very remarkable-looking structure, quite the reverse of beautiful in the exterior. Although large in dimensions, the proportions have not been well arranged, being much too narrow for its great height of full 80 feet. In the interior there is a gallery at an elevation of 35 feet from the ground floor, from which visitors obtain a fine view of the plants both under and above them. Some of the larger growing kinds of Palms have reached to the top of this vast structure, and are, no doubt, the largest examples of their kinds in Europe! The fernery contains a good collection of the different kinds of Ferns in general cultivation, along with some rare species.

Among the *Selaginellas* was one very pretty and interesting species, which no doubt will become a favourite in collections—namely, *Selaginella Vogelii.* The garden is rich in Cycadaceous plants, and also in Succulent plants generally. There are many good examples of Melocacti and Echinocacti among them; also Agavas and Aloes. Taking physical and other ordinary circumstances into consideration, Dr. Regel and his assistants deserve high praise for the healthy state the large collections of plants at the Imperial Gardens of St. Petersburgh are in.

The library, herbarium, seed rooms, &c., are in connexion with the range of conservatories, a covered way leading from the Palm House to them.

The plants in the herbarium are arranged after the system of Endlicher, in cases which are easy of access along both sides of a long room. Those of the Flora of the environs of St. Petersburgh are kept separate for the use of students, and also preserved specimens of many of the plants which have from time to time flowered in the garden. Several of the large collections made by some of the many collectors sent out by the Russian Government to explore portions of its vast regions are kept apart from the general herbarium; for example, that of Ledebour, Maximowicz, &c. The library contains upwards of 15,000 vols., among which are to be found all the principal works on botanical literature which have been published in Europe and elsewhere. This department is chiefly under the management of Dr. Trautvetter and his assistants.

It was interesting to meet at the Congress some of those hardy explorers, among whom I may mention the venerable Professors Bunge and Ruprecht.

Another of the excursions was made to Peterhoff and the Palace of Zinamenskoe, where the Grand Duke Nicholas Nicolavitch entertained the whole party to a grand *déjeunér*. The many places of interest there, including the extensive gardens and parks, gave full enjoyment for the day, with which all present seemed satisfied. The last day's visiting, Saturday, the 22nd, was spent among the museums and galleries of St. Petersburgh, and the whole affair was wound up by a grand banquet on the Sunday, under the Presidency of General Greig, given by the members of the Horticultural Society of Russia.

FROM ST. PETERSBURGH TO MOSCOW.

Previous to this the English party for the most part had left St. Petersburgh to visit Moscow, the journey from the former to the latter being a long and dreary one, through extensive, nearly level plains all the way. For upwards of 300 miles the line of railway passes through woods and marshes, with comparatively small portions of the country arable. It is only when these large cities are approached that cultivation is yet seen extensively carried out. We were fortunate enough to reach the ancient capital of the Muscovites in time to hear the great bells tolled on Sunday in summoning the Orthodox Russians to prayers, which is considered one of the greatest treats this unique city affords to strangers. I was desirous to see the markets—how they are conducted, and the goods exposed for sale; consequently, after visiting some of the churches, I went to the vegetable and fruit market, near the Kremlin. The goods were exposed in a large space in the open air, without any covering or shelter, and included fruit, vegetables, poultry, butchers' meat, &c. At that late period of the year for potatoes, the supplies were large, and the quality excellent; also parsnips, carrots, onions, leeks, and garlic in large quantities. Asparagus, lettuce, and radishes plentiful, the former of fair quality, but nearly all blanched white. In Russian cookery asparagus is largely used, sliced up and boiled in soups, for which the white colour is preferred. The radishes, which are a different variety from those usually grown in England, being much larger and more purple-coloured, are eaten generally before dinner with caviare, &c., for the purpose of sharpening the appetite. Mushrooms were also on sale in two kinds—one our common *Agaricus campestris*, the other a large white species; and what I had not before seen in such quantities anywhere else, common morells, *Morchella esculenta*. The flower market was very poor in the quality of the flowers, but not so much so in quantity. The roughly made up bouquets consisted chiefly of branches of *Prunus padus*, *Lonicera alpigena*, *Amalanchier vulgaris*, *Myosotis alpestris*, and Lily of the Valley, *Convallaria majalis*, the latter not yet in flower, on 23rd May. Another flower market, or rather tree and flower market, near the Tuer Boulevards, consisted of a series of small nurseries, where a great many trees and plants are grown in pots, including common forest trees, fruit trees, and ornamental plants, both woody and herbaceous. There the forced roses in pots were remarkably fine, and sold fully as cheap as plants of similar quality sell in our flower markets.

The principal kinds of trees observed planted in the gardens of the Kremlin and Tuer Boulevards, were Limes, Poplars, Birch, Elm, Mountain Ash, Willows, and one or two kinds of Acer. Among the Poplars was one fine species with large dark green shining leaves, resembling *Populus balsamifera*, probably *Populus latifolia* or *Populus suaveolens* [?] The shrubs planted through the shubberies in the gardens of the Kremlin are different kinds of *Caraganas*, *Spiroeas*, *Loniceras*, *Sambucus racemosa* and *Syringa vulgaris*, the latter of which was not then in bloom, and did not appear to thrive well there. These gardens are rather tastefully laid out, and afford pleasant promenades for the people. The Botanic Garden at Moscow is only a poor affair, the conservatories being much worn out, and containing only a small collection of plants for an establishment of the kind. The collections of arranged herbaceous plants are also small. Among the trees we observed some fine examples of *Acer platanoides* and *Acer rubescens*. Large quantities of *Anemone ranunculoides* seemed to be growing spontaneously through the garden among the grass and under the trees, also *Corydalis bracteata* and *Melittis grandiflora*. Our time here was so short, we were not able to make farther explorations.

RETURN FROM MOSCOW TO ST. PETERSBURGH.

In returning from Moscow to St. Petersburgh, the native trees along the line of railway were much better in leaf than when we passed before, though the intervening space of time was so short. Among them we observed some kinds of Poplars, which were conspicuous by the dark purple colour of their young leaves. None of us seemed to be acquainted with them, judging from the distant view of them from the railway, and probably they are not yet introduced to our Western collections, where they would prove acquisitions, owing to the high colour of their young leaves in spring!

After visiting the Botanic Gardens of St. Petersburgh a second time, and saying farewell to our Russian friends, some of us left *en route* for England by the same line of rail we had come to St. Petersburgh by.

RETURN FROM RUSSIA TO ENGLAND, THROUGH PRUSSIA AND BELGIUM.

We made only a short stay at Berlin, where we had an opportunity of seeing the common *Robinia Pseud-Acacia*, with some of its varieties in full flower. The size of the trees there and the profusion of bloom they produce exceed anything of the kind we have seen in Britain. No farther delay was made until Ghent was reached, where I visited the extensive establishments of M. Van Houtte, M. Verschaffelt, and other plant merchants there, for the purpose of making selections and exchanges of plants, as has been the case on previous occasions when I visited Belgium. After reaching London, as little delay as possible was made at that busy period of the season, until I arrived in Dublin, having been only thirty-two days absent altogether.

XLV.—*Hydrogen as a Gas, and as a Metal.* Notes of a Lecture delivered in the Theatre of the Royal Dublin Society, by Dr. J. Emerson Reynolds.

[Delivered May 1, 1869.]

When the programme of this course of Lectures was published, it became evident that the subject of the present one is, by a singular coincidence, closely connected with that of two of the earlier Lectures of the series. I refer to the discourse of Mr. Stoney, on "Meteoric Showers," and of Professor Ball on "Nebulæ." In the latter Lecture, we learned that many of the thin mists observable in the heavens are not star clusters, as they were long supposed to be, but are enormous masses of gaseous matter in a state of intense ignition. The examination of the light emitted by these nebulæ enables us to state with certainty that at least one elementary body well known upon this earth is present in all of them as a principal constituent, and that element is one which chemists call Hydrogen. In Mr. Stoney's Lecture on "Meteoric Showers," he pointed out that some of these strange visitors to our globe, the Meteoric Stones, are found to contain pent up within them a certain gas, which gas has been shown by analysis to be Hydrogen. We find, then, this Hydrogen in enormous quantities throughout space, and at so great a distance from our planet that the human mind is unable to appreciate the interval which separates us from even the nearest of those mighty gaseous oceans. Again, we find this Hydrogen carried to our planet by those strange wanderers of interstellar space, the meteors. And, finally, we have it on this earth, not in the free state, it is true, but as an essential constituent of one of the most important components of this globe, viz., water.

Our object in this Lecture, then, is to study this remarkable element, Hydrogen, as we meet with it here—to determine some of its chief properties, and to ascertain its nature.

It has been already said that our chief storehouse of Hydrogen on this earth is water, but we find it in many other well-known bodies; for instance, in the dreaded "fire damp" of our coal mines we have the Hydrogen combined with another element—Carbon. Again, common coal gas contains a large proportion of Hydrogen; and I have only to mention that this same body is an essential constituent of the bread we eat, the sugar we mix with our tea, the clothes we wear, of our flesh and blood too, in order to show that this is one of the most widely diffused of that class of bodies known to chemists as elementary forms of matter. But, though we find Hydrogen in all the substances mentioned just now, and in many more besides, for the purpose of the present Lecture we shall confine our attention to one of its most remarkable and widely-diffused compounds, viz. water.

Water, in whatever condition we find it in nature, whether solid, liquid, or gaseous (as steam), is a compound body, being made up of two simple forms of matter—the one called Oxygen, the principal constituent of the air we breathe, and the other Hydrogen. Chemists are acquainted with several modes of breaking up the compound, water, into its two elementary components; but one of the most convenient methods we can employ for effecting this analysis of water is to make electricity tear asunder its two constituents. When water is made part of a galvanic circuit, by plunging the two poles of a galvanic battery into a vessel of the liquid, we find that bubbles of gas are evolved at each pole. By a very simple arrangement, we can collect the gases given off at each terminal of the battery; and we then find, on testing the products, that two colourless gases are obtained, possessing widely different properties. We observe that the gas liberated at the end of the wire connected with the platinumplate of the galvanic battery (the positive pole) is colourless, heavier than atmospheric air; and that when a glowing wooden match is dipped into a vessel filled with the gas, the wood burns with great brilliancy, though the gas does not itself take fire. This peculiar gas is therefore a powerful supporter of combustion, though incombustible itself, and is called Oxygen. We now turn our attention to the gas given off at the negative pole of the battery, i. e., at that connected with the zinc plate. This is also found to be a colourless gas, but very much lighter than air, and incapable of supporting the combustion of a burning taper plunged into it; but, though not a supporter of combustion in the ordinary sense of the term, it possesses the remarkable property of burning itself with a pale lambent blue flame. This is the gas Hydrogen—the remarkable body whose chief properties we have now more especially to study.

[Other modes of liberating Hydrogen from water were shown, and the leading properties of the gas demonstrated.]

When Hydrogen burns in air, its sole product of combustion is water; hence the name of this remarkable substance signifying "water-producer." But Oxygen and Hydrogen can also be made to combine and produce water, when presented to each other *in conditione nascenti*, or at the moment of liberation from other forms of combination. The importance of knowing this fact will be apparent further on.

The beautiful researches of the late Professor Faraday have made us familiar with the fact that many of the gases known to chemists are merely the vapours of extremely volatile liquids; for, on subjecting these gases to very great pressure and to intense cold, in many cases liquids are obtained and even solids, which, on removal of the pressure under which they were produced, resume the gaseous condition at ordinary temperature. Hydrogen has been likewise subjected by the learned Dr. Andrews, of Belfast, to enormous pressures, and to extremely low temperatures, but without exhibiting the slightest tendency to condensation. Hence it has generally been considered a permanent gas; but recent investigations conducted by the Master of the British Mint, the learned and distinguished Professor Graham, tend strongly to show that Hydrogen gas, as we meet with it under ordinary circumstances, is really *the vapour of a highly volatile metal.*

It may be now generally stated that, when a solution containing a metal and a non-metallic body is decomposed by a galvanic current, the metal is usually deposited on the negative pole, and the non-metallic body on the positive electrode. If, for instance, we take a solution of common blue vitriol, or sulphate of copper, and plunge the poles of a battery into the liquid, we find that immediately metallic *copper* is deposited on the wire forming the *negative* pole, while the sulphuric acid (a non-metallic body) appears at the positive end. If now we plunge the two poles into plain water, which, as we have already seen, is a compound of Hydrogen and Oxygen only—the Hydrogen appears at the *negative* pole, and the Oxygen at the opposite one. We learn, then, in applying the galvanic test, that Hydrogen arrays itself on the side of *metals*, and this fact is completely in accord with the view of its nature referred to above.

Again, it is a well-known fact that metals are capable of uniting with each other so as to form compounds called *alloys*: thus, brass is an alloy resulting from the fusion together of the two metals, copper and zinc, in suitable proportions. But it is not always necessary that the two metals should be heated together in order to make them combine; for, if we take a slip of gold, and plunge it into some of the liquid metal, mercury, or quicksilver, as it is called, the gold and mercury combine with each other to form an alloy or "amalgam," possessing a strong metallic lustre. To go just one step further—if we convert this metal, mercury, into a colourless, invisible gas, which we can do by applying sufficient heat, and that into a vessel filled with this mercury gas we plunge a slip of gold, we find that the two metals combine or amalgamate nearly as easily as under ordinary circumstances. If, then, we can accomplish so much with the mercury gas, whose metallic nature is certain, why may we not make Hydrogen gas alloy with some metal also?

By the very beautiful and interesting discovery that certain metals possess the power of absorbing enormous quantites of Hydrogen without loss of metallic appearance, Professor Graham has greatly strengthened the evidence in favour of the metallic nature of Hydrogen, and has even gone so far as to calculate the density of the metal, which he calls "Hydrogenium."

Professor Graham found that certain metals—palladium and platinum more particularly—possess the extraordinary power of absorbing large volumes of Hydrogen gas, and retaining it in some kind of combination. In order to demonstrate this, it is only necessary to take a plate of palladium foil, and, having connected it by a wire with the zinc end of a galvanic cell, to immerse the plate in acidulated water, the positive pole being connected with a plate of platinum likewise immersed in the liquid, Hydrogen is immediately set free at the palladium surface, and Oxygen at the platinum end. The latter gas is given off in bubbles from the platinum, whereas the Hydrogen is absorbed by the palladium.

The palladium is capable of thus absorbing about *nine hundred times* its volume of Hydrogen, and this enormous absorption or condensation of Hydrogen within the pores of the metal takes place without any material alteration in the colour of the palladium, *the latter retaining its metallic appearance.* This, amongst other circumstances, induced Professor Graham to regard the charged palladium as being a true *alloy* of palladium with the metal *hydrogenium;* for it has been found that when two metals unite, the compound resulting retains the characters of a metal, whereas this is not the case when a metal and a non-metallic body combine. In order to exhibit this absorption on a large scale, I have arranged the following experiments:—

A small glass cell is partially filled with water, slightly acidulated with sulphuric acid. Into this water a bar of metallic tin is dipped; this bar is of the size shown at T, Figure 1, and is supported in a horizontal position by means of a varnished wire clamped to the side of the glass cell with the aid of a binding screw. Having secured T in its position, we now take a slip of rather stout palladium foil, about four inches long, and a quarter of an inch wide, and coil it as shown at P; to the end within the spiral is now attached a fine fibre of glass by means of a minute quantity of cement, and this is so adjusted that the glass shall act as a needle indicator, as shown in the diagram. The palladium is then attached to the edge of the glass cell by means of a binding screw and varnished wire. When the cell, so arranged, is placed at D, Figure 2,* the image is projected on the screen, as in Figure 1.

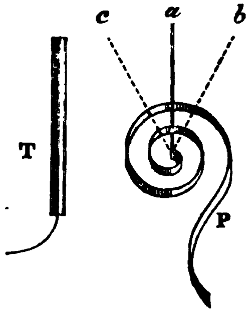


Fig. 1.

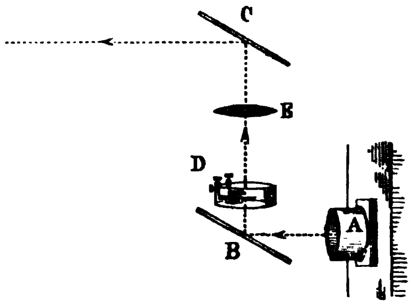


Fig. 2.

---

* This projection may be most conveniently effected by means of the apparatus shown in section at Fig. 2, and which was arranged for me by Mr. Yeates of Dublin. At A we have the front of a lantern with the object glasses removed, the light oxyhydrogen, oxycalcium, or any other, having to pass only through the condensers. After passing the condensers, the rays fall on an ordinary mirror, B, suitably inclined to the beam of light, so that the latter may be reflected in a vertical direction, as indicated by the dotted line. Immediately above this mirror is placed on a wooden support the flat glass cell D, about an inch in depth, and of any required size. Above this vessel is placed a double convex lens, E; the height at which this must be placed above D will depend on the focus of the lens, and is readily found by ascertaining the point at which the image of the object placed in D is most clearly defined on the screen. The rays reflected from the first mirror, B, and having passed through D and E, now fall on a second mirror, C, by which means they are projected on to the screen, and, when the focus is properly adjusted by shifting E, a well-defined image of any object placed at D is shown erect on the sheet.

Without disturbing the apparatus, we now connect, by means of the binding screw and a copper wire, the palladium spiral with the zinc plate of a galvanic battery—one or two cells are sufficient— and the tin rod is connected with the opposite plate of the battery. Immediately on making contact the water is decomposed by the electric current, Hydrogen being liberated at the surface of the palladium, and Oxygen on the tin. The latter gas is set free in bubbles, but the Hydrogen, instead of being liberated in the gaseous form, is absorbed by the palladium; the volume of the metal is thereby increased, and the coil opens out as if endued with vitality. In doing this the glass needle is made to travel over several feet on the screen, and assumes the position represented by the dotted line *b*.

In this way we are able easily to show the expansion of the palladium then charged with Hydrogen; but it is obvious that, on the removal of the Hydrogen, the needle should return to its original position. In order to take away the Hydrogen from the palladium, we have simply to reverse the poles of the battery; that is to say, we now connect the tin bar with the negative wire, and the palladium with the other pole. Now, on passing the current, Oxygen is set free at the surface of the palladium spiral, and Hydrogen on the tin. The Oxygen liberated in juxtaposition with the Hydrogenized palladium, unites with the Hydrogen, and forms water, no material amount of Oxygen appearing at the surface of the palladium until all the Hydrogen has been removed from the latter.

If we watch the effect of the change produced in this way on the screen, we find that according as the Hydrogen is removed from the palladium the needle begins to move from the position it assumed at *b*, when the spiral was charged with Hydrogen, or alloyed with Hydrogenium, if we prefer the term, until it returns to the starting point, *a*. Instead of resting there, as it ought to do, however it travels on steadily until it reaches the position *c*; thus demonstrating the singular fact that the contraction of the palladium on losing its charge of Hydrogen is *double* the amount of its previous expansion. Professor Graham accounts for this singular phenomenon by supposing that the particles of the metal slide over each other in a lateral direction, so that the band of the palladium is unusually shortened, though its density is not increased, since reduction in length is accompanied by a proportional increase in other dimensions.

It is found that this palladium foil charged with Hydrogen possesses most powerful reducing properties—that the Hydrogen within it is just as capable of reducing silver salts as a metallic layer of zinc would be. As illustrating this point, we may cite an experiment: A plate of palladium foil was charged with Hydrogen, as above described, and then immersed in a solution of corrosive sublimate; almost immediately a white precipitate of calomel made its appearance, and when the action proceeded a little further, mercury was reduced. On repeating this experiment with a slightly alkaline solution of nitrate of silver, the metal was quickly thrown down on the palladium plate, and when an alkaline solution of gold was used, the metal was likewise precipitated. These precipitates were obtained under circumstances in which the ordinary Hydrogen gas or palladium foil alone would have been quite incapable of effecting reduction.

We have already seen that Hydrogen can be liberated from the charged palladium by presenting to it Oxygen *in conditione nascenti*, but it can also be set free by heat, or by reduction of the pressure of the atmosphere surrounding the charged plate. If a palladium wire be made to absorb as much Hydrogen as it can take up, and if the tip of the wire be heated in the flame of a spirit lamp, Hydrogen gas is liberated, and burns on the surface of the palladium, the flame continuing until all the gas has been set free. Again, if a similarly charged wire be placed under the receiver of an air pump and the air exhausted, the Hydrogen is completely liberated in its ordinary gaseous condition.

In order to complete this account of hydrogenium, it is only necessary to mention that its density is stated to be nearly 2, or about equal to the specific gravity of the metal magnesium; but the means by which Professor Graham has arrived at this result, though very ingenious, are so unsatisfactory that we must take this estimate as being a mere approximation to the truth. In all probability we must wait for the accurate determination of the specific gravity of hydrogenium until the metal itself will have been isolated in a pure condition.

Thus, in the course of this Lecture, we have liberated Hydrogen, "*as a gas*," from water, and in this condition have studied some of its properties. Again, we have made this remarkable element alloy itself with palladium; and when thus appearing in the guise of "*a metal*," we have noted the chief phenomena it gives rise to. And now, like the bird from its cage, we will set free this Hydrogen from its prison house of palladium, and let it mingle with the mighty aërial ocean in which we live and move.

XLVI.—*The Great Melbourne Telescope.* A Lecture by Howard Grubb, C. E.

[Delivered May 29, 1869.]

A considerable portion of the Lectures that have preceded this have been devoted to the explanation and consideration of some of those recent and important discoveries in the various branches of scientific research which have rendered this century pre-eminently the age of discovery; and at least two of them have treated of subjects more or less closely allied to that of astronomy. It may, therefore, be interesting to you, having heard so much of these discoveries and additions, so to speak, to our vast survey of the heavens, to hear something now of the means by which these investigations are carried on—to learn, in fact, something about the nature of the instruments employed, and the manner of using them in this ever-widening range of the astronomer.

Following the precedent of Professor Ball, and as a fit sequel to his Lecture on the Nebulæ, delivered a short time since in this theatre, I have selected one particular instrument to form the subject of this Lecture. That instrument is the Great Reflecting Telescope recently constructed for the government of Victoria, and I have chosen it for three reasons:—

1. Because, being the most modern and most perfect of its class, embracing as it does all modern improvements, in explaining it it will be necessary for me to describe also some of the most important that have preceded it, and thus I hope to render the Lecture a little more general than would be otherwise possible;

2. Because, having been myself engaged in the carrying out of the construction of this Telescope, I have the most intimate personal acquaintance with all its details; and

3. Because, inasmuch as this Telescope was designed by a fellow-countryman, and constructed and erected in Dublin, it seems natural that a description of it would be the most interesting to a Dublin audience.

I have provided means for illustrating the Lecture, as I proceed, by the gas Microscope, whose aid I shall also enlist for the exhibition of any diagrams I may require for the better explanation of the novel features of the instrument.

It may be interesting to some here to learn a little about the history of these reflecting Telescopes. I shall, therefore, before entering upon a description of the individual instrument which forms the subject of this Lecture, glance in a cursory manner on the characteristic features of a few of the most important that have preceded it; and, in doing so, I shall make choice of such examples as may best illustrate the various types of Telescopes and Telescope mountings, from their earliest infancy to their present maturity.

HISTORICAL SKETCH.

The first class, or type of reflecting Telescope was invented by James Gregory, a Scottish astronomer, and described by him in his "Optica Promota," 1663. In 1664, Gregory had a reflector made by the first opticians of the day; not taking sufficient pains with the adjustments, he failed in obtaining a satisfactory result, but attributed his failure to the want of perfect "figuring" of the mirror.

In 1666, Sir J. Newton, believing that the different refrangibilities of the rays of light were an insuperable bar to the improvement of refracting Telescopes, and perhaps influenced by the idea thrown out by Gregory, made with his own hands the first reflecting Telescope ever turned to the heavens; but, impressed with the idea of the imperfections due to Gregory's construction, he devised the second or Newtonian type of reflector.

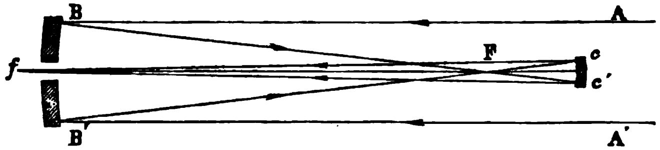
I have upon the table several models of Historical Telescopes; and not the least interesting, perhaps, is this—a model of Sir I. Newton's first Telescope; and I have purposely made this to the same scale as this model of the Great Melbourne Telescope, that you may be able to form an idea of the relative sizes of these, the "alpha" and the "omega" of reflecting Telescopes. The actual dimensions of this Telescope were about 1⅜ inch diameter, and 6-inch focus. Sir J. Newton afterwards made another, of about 18-inch focus, which he presented to the Royal Society, where it is still to be seen by the curious.

Now, it will be interesting, I think, to explain as I go on the exact difference between the four principal kinds of reflecting Telescopes—viz., Gregorian, Newtonian, Cassegrainian, and Herschelian. The first—the Gregorian—looks perhaps the most complicated of all; but I shall endeavour to make it clear to you by this model.

(1). GREGORIAN REFLECTORS.

The parallel rays AB, A′B′ (in diagram), falling upon the large mirror BB′ are reflected and conveyed by it to a focus at F, where an image is formed of the object under observation; but, as it would be very inconvenient to observe it here, the rays are allowed to pass (diverging) beyond this focus for a certain distance, where they are received on a small concave mirror C′C, which reflects them back again, and at the same time, by means of its concavity, alters their divergence to a convergence just sufficient to bring them again to a focus at *f*, where the image can be conveniently observed through a hole in the large mirror BB′.

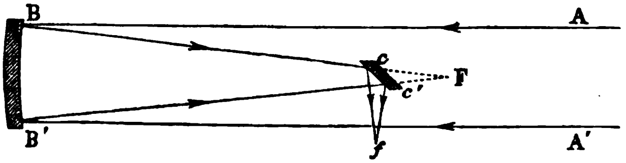
Fig. 1.



(2). NEWTONIAN REFLECTORS.

In this form the parallel rays AB, A′B′, are reflected and converged by the large mirror BB similarly to the first type (Gregorian); but before they reach the point F, where they would, if uninterrupted, form an image, they are received on a small plane mirror CC′, placed in a diagonal position, which throws the rays out to the side of the tube, where they form an image at *f*.

Fig. 2.

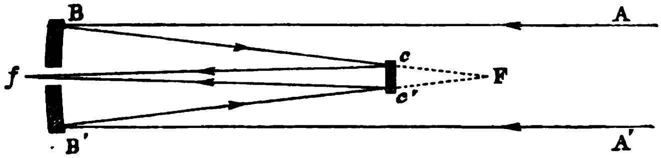


(3). CASSEGRAINIAN REFLECTORS.

This third type is called after a Frenchman of the name of Cassegraian. He claimed the invention not only of this particular type, but of reflecting Telescopes generally, and asserted the superiority of his instrument to other forms, on grounds quite unreal. He seems never to have tried this Telescope, and it was completely ignored for upwards of a century and a half. But I may here mention, as a curious fact in the vicissitudes of Telescope history, that notwithstanding the advocacy of Newton to his own form, the Gregorian was the favourite instrument for upwards of a century, and the Newtonian was only rescued from its temporary obscurity by Sir W. Herschel; and now, the Cassegrainian, the despised and contemned Cassegrainian, has outstripped all others as regards convenience for large equatorially mounted reflectors.

In Cassegraian's construction the parallel rays AB, A′B′ reflected from the large mirror BB′ are received *before* they form an image on the small convex mirror CC′, which reflects them back again, and reduces their convergence just so much as enables them to form an image at *f*, where it is viewed, like the Gregorian, through a hole in the large mirror BB′.

Fig. 3.



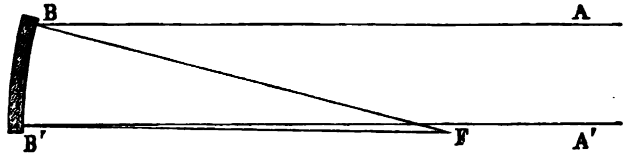
This form possesses many advantages over the Gregorian, one of which is quite apparent from these models, viz., it is very much shorter, which is a very important matter in large instruments. But there is another more important advantage not evident from the models, viz., that the spherical aberration as it is called, (that is, the aberration or error due to a spherical surface) of the large and small mirrors tends to correct each other, while in the Gregorian it acts in the same direction in both, and consequently is augmented. The only advantage in the Gregorian is one, valuable indeed for small terrestrial Telescopes, but quite useless for celestial—viz., the property of representing objects "*erect.*"

(4.) HERSCHELIAN REFLECTORS.

For many years the Gregorian was the favourite instrument; and many of them, constructed by Short, an Edinburgh optician, admirable instruments of their kind, varying in size from 3 in. to 18 in., are still in existence. Sir W. Herschel was, however, the first who attempted experiments on that grand scale which has gained for some of the modern Telescopes the title of "monsters."

Before Sir W. Herschel commenced his great 4-feet reflector, under the auspices of King George III., he is said to have made of Newtonians: 200 6-inch, 150 9-inch, and 80 18-inch aperture, making in all 430 Telescopes; and in 1781, he commenced a great aërial Telescope of 30 feet focus, which, however, he laid aside in undertaking, under the king's patronage, the construction of his greatest Telescope of 4 feet diameter and 40 feet focus. For this Telescope Sir W. Herschel used what is now generally called the *Herschelian* or front-view construction — although it was suggested, but not tried before, by a Frenchman (Le Maire).

Fig. 4.



In this construction the great mirror BB is slightly tilted to one side, so as to throw the principal focus to a position F, where it can be observed with tolerable convenience. This form possesses one advantage—viz., That the primary image of large mirror can be observed without second reflection. This single advantage, important as it no doubt is, is counterbalanced by many objections, foremost among which is the difficulty of obtaining the correct figure or form of surface, which in this case should by a portion of a paraboloid cut excentric to the axis. Sir W. Herschel did not, however, attempt such refinement.

THE EARL OF ROSSE.

The labours of the late Earl of Rosse, and his grand success in constructing and mounting large reflecting Telescopes, are so familiar to us, that probably it is now unnecessary for me to say much about those instruments, which themselves form the noblest monuments ever to be erected to the memory of that departed genius, which this country is, and has such reason to be, proud of.

As, however, I have through the kindness of Professor Downing of Trinity College, models on the table of Sir W. Herschel's 4-feet, an, Lord Rosse's 3 and 6 feet, I shall take the opportunity of explaini d them in a very few words. . . . . ng

GREAT MELBOURNE TELESCOPE.

We have now arrived at the time when the question of the desirability of sending a large Telescope to the Southern Hemisphere was mooted.

I hold in my hand a printed copy of the correspondence which passed between the various scientific authorities on the subject. It is opened by a copy of a resolution of the Council of the British Association, read at a meeting of the Royal Society, November 25, 1852:—"That it is expedient to proceed, without delay, with the establishment in the Southern Hemisphere of a Telescope not inferior in power to a 3 feet reflector; and that the President of the British Association, with the assistance of the following gentlemen—viz., The Earl of Rosse, Dr. Robinson, Lord Wrottesley, J. C. Adams, Esq., The Astronomer Royal, J. Nasmyth, Esq., W. Lassel, Esq., Sir D. Brewster, and E. J. Cooper, Esq., be requested to take such steps as they shall deem most desirable to carry out the preceding resolution."

Then, there follow about twenty letters, which may be considered to embrace the views of all the astronomers of Great Britain, including one from Rev. Dr. Robinson, mentioning his own views, and those of my father on the subject. After duly considering all plans submitted, the committee arrived at the following resolutions:—

"1. That the Committee approve the proposition made by Mr. Grubb, contained in Dr. Robinson's letter, 30th June.

"2. That application be made to Her Majesty's Government for the necessary funds.

"3. That the Presidents of the Royal Society and of the British Association, accompanied by Dr. Robinson, who was associated with the Earl of Rosse in the former application, and Mr. Hopkins, President elect of the British Association, be a deputation, to communicate with Government respecting the two preceding resolutions.

"4. That the Earl of Rosse, Dr. Robinson, Mr. De La Rue, and Mr. Lassell, be a sub-committee for the purpose of superintending the progress of Mr. Grubb's undertaking."

This ends the first era in the history of this Telescope, as the application to Her Majesty's Government met with the usual fate of such applications having for their object the encouragement of scientific progress. In 1862, however, the Government of Victoria, with that colonial energy and decision which assuredly ought to make home ministers blush (if ministers are capable of such little human weaknesses), signified their wish to have such a Telescope at their own expense, and requested the Royal Society to give their aid in procuring a Telescope of undoubted excellence, and as perfect in every particular as it was possible to procure in the present state of the art. Again a long correspondence, lasting about twelve months, ensued; more designs were proposed; and my father submitted a drawing and specification of his design, which was again approved of; and after some considerable delay, due to ulterior causes, the contract was signed in the early part of 1866, and the work immediately proceeded with under the general superintendence of three commissioners appointed by the Royal Society—viz., The Rev. Dr. Robinson, the late Earl of Rosse, the vacancy caused by whose death was filled by the present Earl, and W. De La Rue, Esq.

Having now given you a slight sketch of the history of this Telescope, which, from the voluminous nature of the correspondence, and the evident care taken to obtain the opinion of all astronomical savants, cannot fail, I think, to impress upon you the importance attached to it by the scientific world, I proceed now to describe the instrument itself; but, as I have as yet given you no example of equatorial mountings, allow me first to say a few words about this class of instrument.

An equatorially mounted Telescope is essentially one mounted on two axes, one (the polar) placed parallel to the axis of our planet, the other (the declination), at right angles to it.

It will be evident by a very little consideration that in such a construction the apparent motion of celestial objects due to the diurnal revolution of our earth will be exactly counterbalanced by a corresponding angular motion of the Telescope round that one of its axes (the polar) which is parallel to the axis of the earth—so, by applying a system of accurate clockwork to drive the Telescope on its polar axis at such a rate as would carry it one complete revolution in twenty-four hours, we are enabled to keep any star or other object in view for any desired time. I need hardly say that in these other (altazimuth) forms such a motion would be, though not actually impossible, extremely complicated and ineffective. Now, there are three distinctive types of equatorial mountings,—viz. 1. Long polar axis; 2. Biforked polar axis; 3. German form. We shall now exhibit to you by means of the gas microscope diagrams illustrative of these three types of equatorial mountings.

1st Type.—Our first illustration is that of the 12-inch Telescope presented to the Cambridge University by the Duke of Northumberland, and called after him the Northumberland Equatorial. In this form you will perceive that the Telescope swings between the sides of a large wooden trussed framing, which framing turning on a pivot on either end forms the polar axis. The polar axis in this construction is necessarily longer than the Telescope, and forms a serious element of weakness, particularly as the Telescope is hung on its weakest part.

2nd Type.—This view represents Mr. Lassel's great 4 foot Equatorial of the second or biforked polar axis variety. This is the only equatorially mounted Telescope in the world equal in size to the Great Melbourne. It was temporarily erected in Malta and is now dismounted. In this form you see the Telescope is mounted in a biforked prolongation of the polar axis, the axis itself being a heavy cone-shaped casting. This Telescope is of the Newtonian form—the position of the eye piece of which, in such large Telescopes, equatorially mounted, is highly inconvenient, being generally twenty-five or thirty feet from the ground.

It would take up too much of your time if I was to enter into the reasons why these two forms of equatorials were passed over, and the third preferred. I shall, therefore, at once show you on the screen a photograph of the Great Melbourne Telescope, as illustrative of the

Third, or so-called German Form, as improved by my father's system of internal equipoise, &c. *See plate.*

A. Is a solid piece of masonry, supported on a firm foundation, on which stand

B B. Two cut stone piers.

C. Is the polar axis. It is made up of four distinct parts—viz., a cube three feet on sides, to which is bolted on one side a cone eight feet long, which terminates in a bearing 12 inches diameter, resting in a peculiar "Plummer block" on the polar pier; on the opposite side a short toe piece which carries on parts prepared for them the two hour circles, sector, and clamp, and terminates in a pivot six inches diameter resting in a Y block on Equatorial pier; and on third side a bell-shaped casting, two feet long, which terminates in a slide carrying one bearing of declination axis, the other being in side of cube opposite bell.

The declination axis is 24 inches diameter at the bearing next Telescope, and 12 inches at other; the bearings being 5 feet asunder, and the axis itself 9 feet long. It carries at one end the Telescope T, strapped into its cradle, and at the other counterpoise weights (*U*) to balance the Telescope, amounting to about 2¼ tons.

Of the tube *T*, 7 feet is made of boiler plate iron ¼ inch thick, to which is attached by flangs and bolts a skeleton or lattice tube, 21 feet long, formed of steel bars 3 inches wide at bottom, 1⅓ at top, and ⅙ inch thick, wound spirally round rings of carefully turned angle iron. This tube combines stiffness, rigidity, and lightness. The 7 feet of boiler plate weigh 1300 lbs.; 21 feet of lattice tube weigh 1370. At the upper end of tube, 25 ft. 6 in. from large mirror, is bolted a very stiff hollow arm of steel plate, on the extremity of which is a V-shaped gun metal casting, in which slides an arm carrying the small convex mirror (the construction being the Cassegrain), 8 inches diameter. This arm is acted upon from behind by a screw; from a pulley on the shaft of which wire cords are carried over little guide wheels down side of tube, and finally round a large wheel that surrounds eyepiece *y*, to which wheel motion is given by the observer for focussing.

D. Is the clock sector. This is a sector or portion of a large wheel cast in gun metal, of 5 feet radius, having tubular steel arms, and cut in its periphery into teeth very accurately, into which gears an endless screw connected with the clock by the shafts *e e*.

This sector is strung on to a truly ground portion of polar axis, in such manner as to work freely round on it, but it is connected to the clamp F by a peculiarly contrived tangent screw.

This clamp F is a ring which surrounds another portion of polar axis, and is capable by tightening a single screw of being clamped tightly to it. When this is done, and the clock set in motion, it carries the whole instrument round on its polar axis at the proper rate, and at same time any slight alteration in its setting can be effected by turning (through Hook's joints handles) the tangent screw that connects sector and clamp.

G. Is a wheel by which a quick motion can be given to polar axis for setting (there is a similar one on other side of pier.)

The position of these wheels is such that they can be turned by a person watching at same time the hour circles R, by which the instrument is set on an object.

H. The toothed wheel acted upon by G to produce the motion, as described above.

I. Is a sector of long radius for relieving the friction (lateral) on lower bearing of polar axis.

K. Upper bearing of polar axis. The axis here rests upon wedge-shaped blocks sliding laterally in grooves, and acted upon by screws at ends of Plummer block, by which both vertical and horizontal adjustment is given to axis.

L. L. l. Apparatus for relieving end pressure of polar axis. Weights hanging on long end of large trussed lever exert, through the peculiarly formed chain, an upward force of about 5 tons on polar axis, thus relieving the "toe piece" from unnecessary friction and danger of "biting."

N. Is sector, lever, &c., connected with the apparatus for the relief of that portion of the friction of declination axis due to the pressure at right angles to the polar axis.

O. P. Levers and roller frame, for the relief of the remaining portion of friction of declination axis, viz., that parallel to polar axis.

R. The declination circle, 30 inches diameter.

S. The declination clamp ring for slower motion, carrying also a toothed wheel, in which gears a pinion V, for quick motion.

T. The tube before described.

U. The counterpoise weights, about 2¼ tons.

V. Pinion for quick motion declination.

W. Tangent screw for slow motion ditto.

X. The finder Telescope, 4 in. aperture.

Y. Small convex mirror.

Z. Clockwork in its niche, connected with the endless screw by the shafts *e*, and the piece of differential wheelwork *s*, for adjustment to lunar rate.

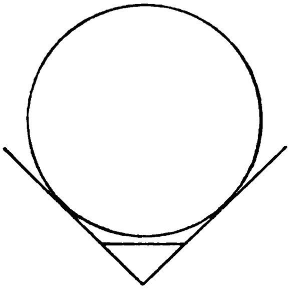
This piece of wheel-work, on being put into action by a small lever, drives the sector instantly at mean lunar instead of siderial rate—final adjustment to actual lunar rate "pro tempore" is made by a small index hand on front of clock.

The clock is kept at a uniform rate by means of a "frictional governor," by which all overplus of power is used up in friction; and this acts so perfectly that doubling the driving weight makes the clock go only $\frac{1}{500}$ part quicker.

Now, in order to give some idea of the manner in which the bearing parts of this ponderous Telescope are arranged, so as to render it, as some remarked, as manageable as a table microscope, I will ask your attention for a few moments to the general arrangement of the bearing and anti-frictional apparatus.

All the bearings are constructed on the same principle as the Y bearings of a theodolite—that is to say, the pivots are allowed to rest on two points only, or at least on two small portions of its periphery, 90° or 100° apart, thus:—

Fig. 5.



This undoubtedly gives the maximum of steadiness; but if allowed to rest on these bearings without some anti-frictional apparatus, the force required to move such an instrument would render it simply unmanageable, and destroy the bearings. In some large instruments the pivots rest on rollers, but this destroys all accuracy and steadiness of motion.

The plan adopted in this instrument is to allow the axis to rest in its bearings with just a sufficient portion of its weight to insure perfect contact, and to support the remainder on some anti-frictional apparatus. Generally $\frac{1}{50}$ to $\frac{1}{100}$ of the weight is quite sufficient to allow the axis to take its bearing, and the remainder $\frac{49}{50}$ to $\frac{99}{100}$ can thus be supported on friction rollers, and reduced to any desired extent without injuring in the slightest degree the perfection of steadiness obtained by the use of the Y's.

This is exactly the plan used in the bearings of the polar axis. The bearings of the declination axis are supported on virtually the same principle; but the details of that construction are necessarily much more complicated, on account of the variability of direction of the resolved forces with respect to the axis. I regret the more that time will not allow me to enter into this important part of the details, as the apparatus in question has only been adapted to this and one other Telescope, and because it is to this apparatus that the freedom and steadiness of motion of these instruments is partly, if not mainly due.

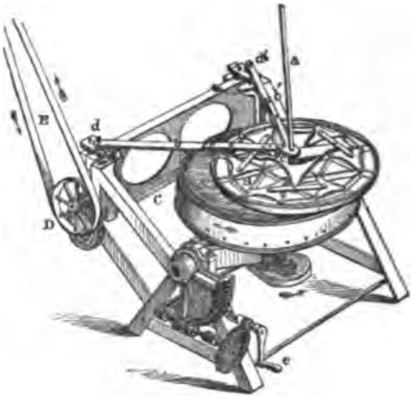
The preparation of the specula was carried on at the same time and in the same premises in buildings specially constructed, wherein the mounting was both manufactured and erected.

The alloy used was rather higher than what has hitherto been used for such large mirrors. The proportion was copper 32, tin 14·77. The mirrors were cast on Lord Rosse's "Bed of hoops," but with several very important modifications of his process.

The annealing was conducted in a circular oven, and took twenty-three days. Immediately on being removed from the oven, the specula were placed on the machine, and rough-ground on front, back, and edge, during which process they rested on several thicknesses of cloth; from this they were removed to their own boxes, where they rested on the system of levers presently to be described. The finer grinding and polishing was then proceeded with, and the specula were never after raised from their supports.

The Grinding and Polishing Machine, as devised long since by my father, is shown in isometric perspective in Fig. 13, where A is the speculum in its box, revolving on a vertical spindle, which, by a peculiar mechanical contrivance, is made to work with great ease and steadiness. B is the grinder, strongly ribbed at the back, and supported from its strongest points by six triangles of wrought iron. Three coupling levers unite these, which are in their turn supported by a strong central tripod. In a hole in the centre of this tripod is inserted a collared cylinder, so formed as to allow of a rocking motion through this cylindrical piece and attached to it by a cross key, passes the bar *a*, which is supported at its upper end by a lever and weights (not shown in drawing), to balance a portion of the weight of the grinder. This vertical bar is laid hold of by the double bar *b b′*, linked at *c*, and to which motion is given by the cranks *d d′*. These cranks receive their motion from the main shaft C, which is worked by the wheel pinion and pulley D, driven by the belt E. By the adjustment of the lengths of the cranks *d d′* of the beam *b b′*, and the relative velocities of the crank, shafts and speculum, all the curves given by Lord Rosse's machine, and any of those given by other machines which have been found practically useful, are obtained. Some consider that the motion of the grinder or polisher should be itself controlled and capable of being regulated at pleasure; but it has been found that the free motion of the polisher forms a most accurate criterion of the action, *pro tem.* If that action be good, the polisher revolves just as it is desirable; but if anything occurs to disturb that good action, immediately it commences to revolve fitfully, either too quickly or too slowly, and thus gives notice of something requiring attention.

Fig. 6.



For the purpose of trial, as it would have been very troublesome to be obliged to remove the speculum to the Telescope on every occasion of trial, the machine is so constructed that by turning a handle (*e*), the whole frame carrying the speculum is tilted into a vertical position by the endless screw and worm *f*, and a dial plate and artificial star being placed at 800 feet distance, the mirror, used as a front view Telescope, is ready for trial in five minutes, which saves some two days' work on every occasion, besides avoiding risk. So efficiently and with such certainty did this machine do its work, that on no occasion, having once ascertained what was required, did it fail in providing the requisite alteration of figure, while as compared with other machines the ease and steadiness of its working were remarkable.

The support of the specula is one of the most important points in the mounting of the large reflector, and one which, if certain difficulties were not disposed of, would be a complete bar in the way of mounting them equatorially. Two things are essentially necessary.

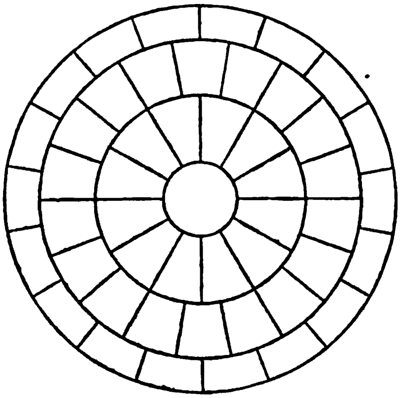
1st. A system of back supports on which the speculum may lie in a state free from strain of any kind, as if in fact it were floating in mercury.

2nd. A system of lateral support which will preserve the mirror free from strain when turned off the zenith, and will not constrain any slight movement of the speculum.

Now, as regards the first condition, nothing could fulfil it better than the system introduced long ago by my father, which was made use of on such a grand scale by the late Lord Rosse as well as by others, and this system therefore with some modification was adopted.

To understand it, suppose the speculum to be divided into forty-eight portions as in Fig. 7, each of them being exactly equal in area and consequently in weight. Now, if the centre of gravity of each of these pieces rested on points which would bear up with a force = the weight of each segmental piece, it is evident that there would be no strain in the mass from segment to segment. This is exactly what is accomplished by this system; in fact, if when the speculum is resting on these supports it could be divided up into segments corresponding to those lines, they would have no inclination to leave their places, showing a perfect absence of strain across those lines. Suppose now the points representing the centres of gravity of these segments were supported on levers and triangles, so as to couple them together as at A, Fig. 8, and each of these couplings to be supported from a point *a*, representing *the centre of gravity of the sum of the segments supported by that particular couple*, and it is evident that there can be no strain between the components of these couples. Again, let these points *a* be coupled together by the system shown at B, Fig. 8, and their centres of gravity *b* coupled as at C, and it is evident that *the whole weight of the speculum ultimately condensed by this system into these points is supported on forty-*

FIG. 7.



eight points of equal support, being the centres of gravity of the forty-eight segments at Fig. 7. In Fig. 9 is seen the whole system complete. It consists of three screws passing through the back of the speculum box (which serve for levelling the mirror), the points of which carry levers (*primary system*) supporting triangles on their extremities (*secondary system*), from the vertices of which are *hung* two triangles and one lever (*tertiary system*). All the joints of this apparatus are capable of a small rocking motion, to enable them to take their position when the speculum is laid upon them. In the system of those levers made by Lord Rosse for his six-feet speculum, the primary, secondary, and tertiary, &c., systems were piled up one over the other, so that the distance from the support of the primary to the back of the speculum was about 15 inches. This, as will be readily seen on consideration, introduced a new strain when the telescope was turned off the zenith, and had to be counterpoised by another very complicated system of levers. But in this Telescope, by the substitution of cast steel for cast-iron, and by *hanging* the tertiary system from the secondary and allowing it (the tertiary) to act in some places through the secondary, the whole system is reduced to 3½ inches in height, and the distance from the support of the primary lever to the back of the speculum is only 1¾ inch, by which means this cumbersome apparatus is entirely done away with.

FIG. 8.

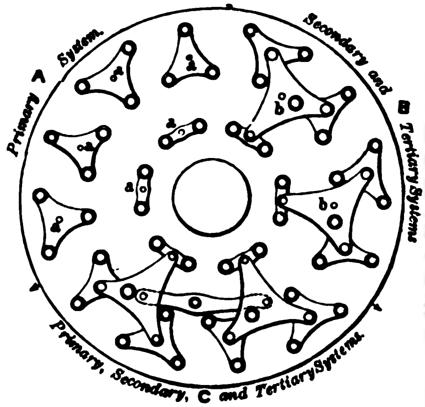
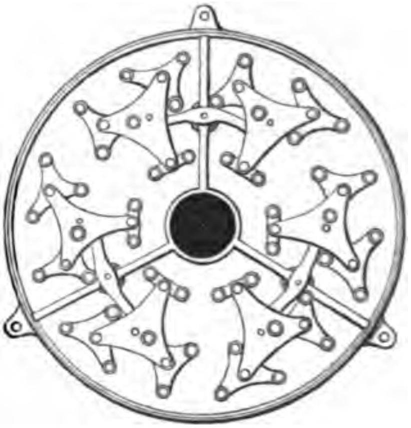

Primary A System
Secondary and B Tertiary Systems
Primary, Secondary, C and Tertiary Systems
a
a
a
a
a
b
b

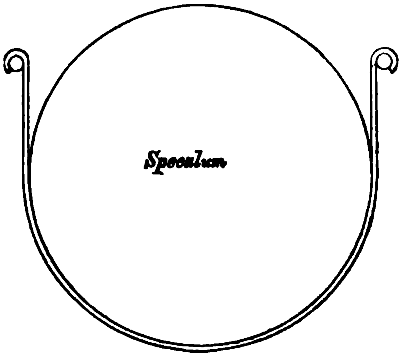
FIG. 9.



The ultimate points of the tertiary system are gun-metal cups which hold truly ground cast-iron balls with a little *play*, and when the speculum is laid on these it can be moved about a small quantity by a person's finger with such ease as to seem to be floating in some liquid.

The System of Lateral Supports was devised specially for this instrument. One objection originally raised to the mounting of these large Telescopes (reflectors) equatorially, was that such heavy mirrors could only be supported *laterally* in a flexible hoop, as in Fig. 10, to preserve them from strain, and consequently it was impossible to mount them equatorially, when they would sometimes be turned upside down, and would roll out of their hoop. Mr. Lassel ingeniously got over this difficulty by making his Telescope revolve in its cradle, so that he could always keep one diameter vertical; but this plan, apart from its inconvenience and clumsiness, destroys all accuracy of adjustment.

FIG. 10.



The system adopted for this Telescope will be best understood by reference to Figs. 11 and 12. Both these figures are sections of the speculum

FIG. 11.

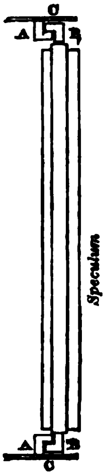
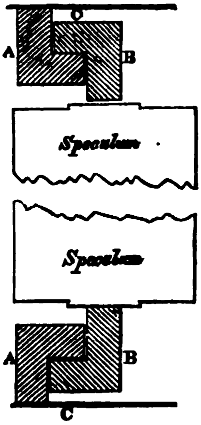


FIG. 12.



and its box, Fig. 12 being enlarged to show better the rings of support. C is a portion of the speculum box, to which is attached on the inside a wrought-iron ring of the section shown at A; this may be considered inflexible from its construction. On this ring hangs another, B, another portion of which embraces the speculum round a part that was carefully trued by revolving' grinders. Now this ring B may be considered as *the indispensable flexible hoop* hanging from A, and on which the speculum is hanging, but with this peculiarity that it is equally effective in all positions; and, again at the upper side the speculum is free from the ring B, while at the lower side the ring B is free from A. Therefore the speculum is not confined in any exact position or prevented from taking a proper bearing on its back supports. This is just what is required, and so effective is this apparatus that on no occasion could any evidence of strain be detected by the most critical observer.

And, now, Ladies and Gentlemen, my task is ended. I have given you, as well as it lay in my power within the compass of a single Lecture an account of this so-called *Great Melbourne Telescope.*

My greatest fear is that, knowing as I do all the details of this instrument so intimately myself, I may have taken too much for granted, and may not have been sufficiently explicit in my explanations. If this be so, I must only refer you to the description of this Telescope in the "Philosophical Transactions," by the Rev. Dr. Robinson and my father, or Mr. Mallet's account in the "Practical Mechanics' Journal," December 1, 1868, and January 1, 1869; or that of Mr. W. Crookes, in the "Quarterly Journal of Science," October, 1868; and those who wish to know something of its performance, to the Report of the Commissioners, and Mr. Lassel's letter in the Proceedings of the Royal Society. And now, thanking you for that patience which I fear I have taxed so much with dull detail, I feel I cannot conclude this Lecture better than by quoting the words with which Dr. Robinson closes his paper on the same subject in the "Philosophical Transactions."

After detailing the noble field of work open to such a telescope in such a situation—"And even they," he says, "who have no special interest in optical or mechanical science, may be reminded that every well-established fact, everything which tends to extend man's control over the inert masses or the energetic forces which surround him, is an element of power—is an agent whose potency may extend far beyond his ken—is an everlasting possession of the human race."

XLVII.—*On Deep Sea Soundings.* By W. ANDREWS, M. R. I A.

[Read November 15, 1869.]

ALTHOUGH the Paper that forms the subject this evening is presumed to be records of deep sea soundings, yet those extreme depths that have characterized the investigations of the dredging cruises during the summers of the past and present year, under the auspices of the Royal Society, could not possibly be attempted—those researches of ocean soundings that have reached to thousands of fathoms, and have brought to light the products of its bed from a depth of three miles.

The appliances that I could command were such as were sufficient to explore the nature of those soundings, the examination of which would test their features as fishing grounds, and that would form records of localities of the various kinds of sea fish that frequented the south-west coast of Ireland, where my inquiries were directed. I shall only at present give a brief introduction, as Papers of much interest are to follow, by Mr. A. G. More, and by Mr. Kirby, assistants in the Museum department, the former especially directed to a most interesting and productive part of the west coast, the harbours and creeks at the northern entrance of Galway Bay.

As one of the Honorary Secretaries to a Society for improving and advancing the Sea Coast Fisheries of Ireland, and aiding the fishermen, my attention this year was more immediately with reference to investigations connected with those objects, and to endeavour to promote their more useful development. The researches, therefore, were directed to the examinations of the peculiar features of animal life, and to characteristics of soundings that varied at different depths within a range extending to eighty-five fathoms. The currents that set towards those shores formed also views of much interest, as influencing the occurrences of fish and of marine animals peculiar to the waters of warmer coasts. Dr. Carpenter and Professor Wyville Thomson have proved the existence of animal life in the greatest known depths of the North Atlantic Ocean, occurring so contrary to the views hitherto maintained by naturalists (with the exceptions of the investigations of Dr. P. C. Wallich), at depths where they must have originated and become permanently located. In short, as Sir Roderick Murchison has observed, it is a well-ascertained fact that deep sea currents exert no transporting agency whatever; and that the smallest fragments of sand and shells remain at the bottom of such deep seas, and lie in an unruffled state.

Much valuable discussion has taken place this year, at the meetings of the Royal Geographical Society of London, with reference to the supposed influence of the Gulf Stream; and Mr. Findlay, whose reasoning appeared sound, believed it to be an error to call the warm stream which flowed towards the western coasts of Europe the Gulf Stream, and that known facts revealed some larger agent at work in producing the mild climate of Western Europe. Singular instances occur of drifts arising from currents; thus, the beans of *Mimosa scandens* have been driven on the shores of Iceland and of Orkney, and the pods and beans of a species of Dolichos on the west coast of Ireland. *Velellæ* in abundance have been drifted ashore in Dingle Bay; and in the month of March last two beautiful specimens of *Physalia* floated into Ventry Harbour.* Sir Edward Belcher mentioned that within the year two sea substances which existed about Teneriffe had blown ashore at Torquay; and in the month of May last a Portuguese Man-of-war has been cast ashore at the same place. Several instances of the tunny (*Thynnus vulgaris*) and of the bonito (*Thynnus pelamys*) have been stranded on the shores of Brandon Bay, Kerry—one within the last three weeks.

Turning, however, to deep sea soundings, it is to be regretted that our surveys are chiefly made only with reference to mere depths and peculiarities of soundings for the uses of navigation, and not with that attention to physical geography, and to those objects of the natural sciences—subjects that our nautical charts might well illustrate and teach. It has been assumed that those views are beneath the position of a naval officer, and that his duties are too important and too responsible to undertake such inquiries. The severe nautical duties that have been performed by Captain Spratt are well known, and yet that gallant officer pursued with ardour all investigations illustrative of physical geography, geology, and natural history. His deep sea soundings and dredgings in the Sea of Marmora brought up from a depth of 1500 fathoms minute and delicate shells. In those soundings he detected that the surface current gradually diminished, and vanished at a depth of forty fathoms, and that no counter-current is found below. Sir Leopold M'Clintock, whose talents and zealous services have raised him to a high position as a naval officer and navigator, studied with intense interest the natural sciences in whatever clime his duties led him, which the valuable and beautiful specimens in the Museum of this Society exemplify.

In carrying out the views I have already alluded to, and being at Dingle during the month of October of last year, my exertions were directed to sound the ground around a rock that was known to the fishermen as the Barrack, the position and bearings of which had never been correctly determined. Unfortunately, during the whole of that month, a succession of blowing weather, varying from S.W. to N.W., continued; and although several beatings were made to the rock, the heavy swell and breaking sea prevented any attempts at sounding.

Some little account of the early notice of that rock may be necessary.

---

* I am indebted to Miss Goodman, of Ballymore, Ventry, for these specimens of Physalia—a young lady much interested in natural history pursuits, and who has made some good collections.

A few years previous to the year 1848, a sprit boat, called the Barrack, fouled her lines (when in moderate weather fishing to the westward for hake) on a rock, having, at the time, but three and a half fathoms over it, the depths close to and around being upwards of thirty fathoms. At that time there were only sprit boats used by the fishermen, and a few canoes introduced from the Shannon. The sprit boats were large, cumbersome, open boats, having two sprit sails, and heavy, ungainly oars. They generally carried seven men and a boy, and were employed, with spillers and hand lines, in fishing for *cod*, *haddock*, *whiting*, *ling*, *hake*, *bream*, *pollock*, and *conger*, and with shallow nets during the season for herrings. These boats could only make to those distant fishing grounds in summer and autumn in moderate weather; consequently the rock was but occasionally visited, and but imperfectly known to the fishermen.

During many of my early rambles in Kerry, my favourite county, I had noted the capabilities of its fisheries, and especially with reference to Dingle. Not losing sight of the observations I had made, I was chiefly instrumental in introducing among the fishermen a larger and more comfortable class of boats, and a better system of fishing, and eventually to establish trawling in the bay, which proved, and still continues to be, a most productive and remunerative employment to the fishermen, besides the accomplishment of making them good seamen and pilots.

My interest increasing in the success of the fisheries, I for many successive years visited Dingle, both in the winter and summer months, exploring the grounds of the bay most suitable for trawling, and having regular logs kept of their bearings, the charts of that day being barren, to some extent, of the soundings of the bay or of the deep water off the coast. From my notes I find that on the 31st July, 1850, I made a long run to the westward of the Great Foze, and to the N.W. of the Tearaght, finding most productive fishing soundings; and was most successful in the taking of the finest *cod*, *ling*, and *tusk*, that had ever been brought into Dingle. On the return cruise we found the Black Eagle sprit boat and two canoes at the Barrack. Their fishing had been successful, but a heavy breeze springing up we had to take the canoes in tow.

Subsequently Commander Edye, with Messrs. Mac Dougall and W. B. Calver, examined twenty-six miles of the projecting peninsula which separates Dingle and Tralee Bays, marking down minutely the soundings of the bays, and the soundings around the Blasket Islands.

It is singular, when the number of the casts of the lead in a square mile is noted, no knowledge was obtained of the position of the rock, which was then known but to a few as the Barrack, and consequently it was not given in the chart, which was completed and published in 1858; nor is any notice of it made when correcting the charts of the survey to 1860.

As I before said, I failed in October, 1868, in my efforts to reach the rock, for the prevalence of strong westerly winds kept up a heavy swell and a breaking sea. Its true position was not at all times attainable by the fishermen, and which resolved me in the present year to work out fully its proper bearings. On the 16th of July last, with a fine northerly breeze, we reached the supposed position of the rock, and, after some soundings, struck on a ledge, and fixed a buoy over its summit, the soundings, at about half tide, being about six fathoms. At low water, at extreme springs, there are barely three fathoms covering the rock. The following bearings by compass have been most accurately made, taking the bearings from the rock:—

Blackhead, or Coombdubh Point, Great Blasket Island, N. ½ E.; Great Foze Rock, N.W. and by W.—5⅓ miles; Slea Head, N.E. and by E. ¾ E.—5¾ miles; Thunder Rock, N.W. and by N.; Garraun Point, Great Island, N.E. and by N. ¾ E.; The Boss, ditto, N. N.E. ½ E.—4⅙ miles; The Tearaght, N. N. W.; Bray Head, S. ½ W.; Valentia Light, S.E. and by S. ½ S.; The three-fathom rock, on the Wild Bank, bore from it E. and by N. ¾ N.—about $3\frac{6}{8}$ miles.

I have given these bearings fully, as vessels coming in from the southward or westward cannot clearly distinguish the Thunder Rock, as it appears closed in with the land of the western island, Innisvickelane. Again, as many of the fishing boats have no compasses, and but few of the fishermen understand the use, or the distances by sea miles, excepting those trained on board the large trawl boats, it is desirable that land bearings should be usefully given. Taking a line of the east side of the western island, Innisvickelane, with a high point on Innisnabroe, and across the centre of the highest point of Tearaght, and then a line closing in Begenish Island with Garraun, the eastern point of the great island, you have the exact position of the rock.

On reference to the present charts, the soundings are given at 38 and 40 fathoms where the rock exists. The singular features of those pinnacle rocks, which occur close in with the islands, are shown in the drawing given of a part of Innisnabroe Island, the formation of which has been termed vertical old red sandstone. The extent of the surface of the rock, the bearings of which have been described, is not great; for soundings may, from the stem of the boat, be had in six fathoms, while from the stern a depth of 16 fathoms, and close around 30 to 40 fathoms, with a hard bottom.

The true bearings and position of the rock having on the 16th July, 1869, been for the first time accurately determined, and which was previously but imperfectly known as the Barrack, I thought it due to the lady, now placed in a leading and onerous position in that part of the county, to name it the Lady Ventry or Barrack Rock, and this intention I had designed, had the weather permitted me to fathom it in October, 1868. In my early visits to Dingle (which caused me to take such an interest in that locality), I had, through the kindness of Sir James Dombrain, the Inspector-General of the Coastguard Service—a gentleman ever anxious to promote useful researches in science—every facility through the Coastguard; and to his introduction to the late

Captain Clifford, R. N., Inspecting Commander, I continued to have in him a warm and zealous friend. Captain Clifford had seen much service, and was first lieutenant in Basil Hall's ship. I can never forget the kind aid I at all times had from the men of the Coastguard, and it was through their assistance that I was first enabled to explore so successfully the Blasket Islands. With Harry Jean, in the Dunquin boat, we found the pinnacled rock off the neck of the Old Man, on which, years after, the Stromboli struck, and which now bears the name of that ship.

As I said, this paper is merely an introduction to a series of notes of the soundings I have made, in many directions, off that coast; and I shall not now touch upon the objects of interest obtained, beyond an allusion to a few points that have been previously noticed.

Off the rock the soundings are 35 to 40 fathoms, ranges of hard bottom with patches of sand. With the dredge were brought up fine specimens of *Tubularia indivisa* and *Tubularia larynx,* presenting most beautiful objects, the animals at the termination of the tubes a mass of asteroid brilliancy of colour; but what were most remarkable were fine specimens of *Paracyathus,* having the forms both of *Paracyathus thulensis* and *Paracyathus taxilianus,* distinguished as the Shetland and the Moray Cup Corals, the latter having a broader base of attachment. From an examination of the animals they are distinct from *Caryophyllia Smithii;* and I suspect that several of the named localities of *C. Smithii* on the Irish coast are more referrible to *Paracyathus.* I obtained fine specimens of *C. Smithii* in deep water, 50 fathoms S. S. W. of Innisvickelane, three miles. The animal expanded its beautiful tentacles, and lived for ten days in a vase of sea water. With the exception of some slight variations of colour, the figure given in Gosse's "Sea Anemones and Corals," is excellent.* Another object of interest was the *Eschara foliacia,* of Ellis, E. *retiformis,* of Ray, stony foliaceous coral, brought up in the living state. This coral is most beautiful. About its base of attachment the colour is a rich warm sienna, shading off to pale crimson, the terminal portion, or margin, being of pale yellow. The examination of this coral in the living state, and comparing my notes on Millepora, afterwards taken, I am certain that a distinct separation exists. In fact, that has been long entertained; for Milne Edwards, who had examined *Millepora cervicornis,* observes that it was entirely distinct from Eschara, with which it has been confounded. The Millepora is a genuine Hydroid, and not a Polyzoa, and is allied to the acalephs, while the Eschara is a Bryozoa or Polyzoa, belonging to the class Mollusks. The *Eschara foliacea* appears to be exceedingly rare, and the only Irish record given of it is in Thompson's 4th volume of the "Natural History of Ireland," as obtained by Mr. W. Todhunter, off Cape Clear, in the winter of 1848.†

---

* Gosse's figure, Pl. X., fig. 12, in *Actinologia Britannica* appears more referrible to *Caryophillia borealis.*

† No Irish specimens appear to be in any collection here, neither is it recorded in

The Crustacea met with were numerous, but at present I shall only refer to one—*Gonoplax angulata*, taken in deep water, off the rock. This beautiful Crustacean is certainly confined to deep water. The late Professor Kinahan mentioned that a single specimen was shown to him that was cast ashore at Valentia after a gale of wind, but he in vain sought for it. In Galway Bay Professor Melville mentions it as rare. Some were thrown ashore at Portmarnock after gales; and the late Dr. Ball obtained them in the stomach of the cod. They are the favourite food of the cod, and cod-fish are plentiful where *gonoplax* frequents.

On the 16th of August last I made a cruise to the south-west, and sounded between the Lemon Rock and the Little Skellig Island, in 36 to 39 fathoms, where the chart marked shells. The bottom, in every direction, was hard, with abundance of *Millepora*, and here I obtained living specimens. The swell of the Atlantic was so heavy that my dredge gave way in the second haul. That evening were obtained, at great risk, the beautiful specimens of the unfledged state of the gannet, which are so admirably prepared by Mr. Robert Pride, the taxidermist to the Society. They were taken from the Little Skellig, the surf at the time breaking heavily around the Island. I may mention that in standing for the Skelligs, a large piece of wreck passed close to the boat, over which hundreds of wreck fish, *Polyprion*, were playing. The sea was too heavy to attempt capture. This fish I first recorded as Irish, at a meeting of the Natural History Society, and in this Society, the capture of a rare fish at Dingle, *Centrolophus*, or black fish of the Mediterranean. Six others of the black fish were taken the end of last month, at Fahamore, Brandon Bay, following a piece of floating timber that came on shore. One of these fish was sent to me by my friend, Dr. Busteed, of Castle Gregory.

In concluding these remarks, I cannot avoid speaking in the warmest terms of the kind and generous conduct of the Dingle men, and their extreme willingness to assist me in my investigations. The employment of a large craft, like the Shamrock, a boat of near sixty tons, was attended with serious expense; and, therefore, I could only take advantage to obtain soundings when the vessel went to distant fishing grounds, although a rich harvest existed around. As an instance of their profits by fishing, the nights of the 17th and 18th of August, the quantity of hake taken, and sold at a shilling per couple, gave a share to the vessel of £6, and to each of the men, £3. The superiority of the seamanship of these men in hard weather was often tested; and none could exhibit more steady or more daring skilfulness than the crew of the Shamrock, under her master and owner, Stephen Long. The family of John O'Flaherty, of Reenbeg, have been long known as the best pilots on the coast, he himself a most daring seaman, and who had saved many vessels from wreck.

---

the dredgings on the south and west coasts, of the late Dr. Ball and Professor Forbes, nor of Thompson, Patterson, Hyndman, Farren, and M'Calla.

The whole scope of the coast from Donegal to Bantry presents a rich field to the zoologist, but examinations cannot be carried out except with truly competent vessels and ample appliances. It was the resources of M'Andrew, Jeffreys, and Barlee, that enabled them to add such rich gatherings to science. It is impossible to say the extent that yet remains to be accomplished in zoology; for, although the most elaborate work has been executed by Captain Bedford and Lieutenants Sidney and Horner, nothing has been obtained beyond accuracy of peculiarities of soundings and bearings. On the coast of Donegal 220 square miles were sounded over by these skilful officers. 23,000 casts of the lead were made; on an average 35 casts to the square mile in deep water; 625 casts to the square mile in a depth of ten fathoms. The same minute soundings have been made on the Wexford and Waterford coasts; yet it has been recently stated that a most valuable and extensive oyster bed has been accidentally discovered in the search for a gold watch that had dropped from a boat.

XLVIII.—*On the Acclimation of Plants.* By MR. JOHN ADAIR.

[Read December 20, 1869.]

AFTER brief introductory observations, Mr. Adair said that, as we all know, the science and practice of plant culture have always, and amongst all people, been pursuits healthful to mind and body, and that no time appears to have more appreciated that art and science than the present; and that acclimating is but a branch of that general culture. Though at any time he would feel pleasure in taking part in the proceedings of this venerable association, in the present day, when the great problem is being worked out, whether modern Christendom contains regenerating elements, which will prevent such ruin as befel the greatest nations of antiquity, he esteems it a high privilege to contribute in however small a degree to the healthy development of those elements. Having from boyhood watched the growth of those political and social powers which have devolved on the working classes, of whom he has always been a member, he feels no surprise at any changes which have of late occurred in the political, social, or religious world.

Living in a highly favoured age, we have philosophies of history, and histories of philosophy, and epitomes of various learning, enabling ordinary men to know their proper place in the grand drama of the world. And history teaches the humiliating lesson, that the clearest and brightest religious light, the most martial achievements, the greatest perfection in art, or the highest intellectual attainments of which any nation as yet could boast, have alone been insufficient to maintain its permanence—that some better blending of the elements of education, and bringing knowledge into practical use, than as yet has been attained, is requisite to keep nations from falling a prey to the pettiest passions and most degrading vices. But history also teaches what apparently trivial matters influence even a country's happiness. From the locusts of Egypt to the parasites which devastate vine and potato, we learn what small instruments Heaven uses to bring about great results. "The locust, the cankerworm, and the caterpillar, and the palmerworm, my great army which I sent among you," are the soldiers which bring man to a true sense of his littleness.

The alarm caused by those growing powers of the working orders already alluded to, has the salutary effect of making popular education a prominent subject of consideration throughout Christendom; and in all education, recreation, and amusement bear a very important part. It seems to need little argument to show that those which most interest, enlarge, and invigorate the different powers of mind and body, without fatigue, are those most deserving of general encouragement. That amongst various branches of natural science and of art culture of plants was a subject of public education at a very early period, seems plain from the brief account we have of King Solomon's lectures, which attracted the attention even of foreigners, and those of the highest rank. "He spake of trees, from the cedar tree that is in Lebanon, even unto the hyssop that springeth out of the wall. He spake also of beasts, and of fowl, and of creeping things, and of fishes: and there came of all people to hear the wisdom of Solomon, from all kings of the earth which had heard of his wisdom." We need not now discuss whether public botanic gardens, and people's parks, and like recreations, tend to advance civilization. What is daily witnessed abroad and at home leaves little room for doubt. Reference was here made to the countless numbers who avail themselves of such recreations, and to their salutary influence on all ranks, especially the working orders. Some dictionaries define acclimating of plants as adapting or inuring them by man's art to circumstances foreign from their usual habits. Johnson calls it accommodating plants to a climate. Perhaps it is not easy to give any definition unopen to objection or cavil; but for present purposes I venture to call it accustoming plants to thrive in a climate and circumstances different from those where the plants are indigenous. And I would remind you that climate and temperature are not synonymous; for we have other differences of climate than hot and cold; we have moist and dry, genial, mountainous, &c. I know that writers of position doubt that there is any such process as acclimating; and if there be, they say it is to only a very limited extent, and within what are called isothermal zones. It may be that no art or human device can alter the essential nature of species; but possibly by causing a change or alteration in the blending of the component elements of plants, some acclimation may be effected by increasing powers of resisting cold or enduring heat, or other altered climate different from that of the native *habitat*.

Though acclimating is regarded as in itself a distinct branch of cultivation, materially differing from naturalizing or hybridizing, it seems not easy to treat of one process without referring to the others. Cultivation, without forcing, brings plants, as it does man, from a low and feeble to a much higher state. By developing hidden qualities, if it do not strengthen the individual imported exotic, it may make the progeny of a feeble parent vigorous and robust; and skilful hybridizing multiplies varieties; and amongst seedlings of one plant and one season some materially differ from others in powers of endurance, as they do in beauty and other qualities. The paper here mentioned the peach, as one instance amongst many, showing what culture and hybridizing has done and is expected yet to do; till, with this tree it even enables it to ripen fruit as a standard in many parts of the kingdom. At all events, so early as Lord Bacon's day, his mind somewhat foresaw what has already been achieved; for he says, "The compounding or mixture of plants is not found out, which if it were, is more at command than that of living creatures; wherefore it were one of the most notable discoveries touching plants to find it out, for so you may have great varieties of fruits and flowers yet unknown."

Though this paper be merely suggestive, and intended to induce amateurs of all ranks to experiment in an interesting field of enjoyment, it seems convenient to have some regard for order in dealing with our subject. So far as I know, what are called herbaceous plants, and low evergreens of herbaceous nature, seem those most easy of acclimation. Herbaceous plants, being soft and succulent, die down to the root yearly, and by the natural protection of snow, and artificial protection with branches, turf mould, cinders, &c., become inured to a climate where otherwise they would perish. *Maize* is often referred to as affording a remarkable instance of adaptation to variety of climate and circumstances. The *Tomato* also was introduced, within the memory of living men, into parts of America and Europe where, at first, it refused to ripen, from the coldness of the climate, but where now it is annually matured with as much certainty as most vegetables. One or two other plants of this class, though of wholly different character, I cannot forbear to name, hoping yet to see them as familiar as now they are strangers to our gardens. I mean *Erythrina cristagalli*, and *Disa grandiflora*, which comes from a lofty range of the Table Mountain. I need not refer to the several varieties of *Acanthus*, *of Tobacco*, and the *Castor Oil Plant*, which are becoming generally known for ornamental foliage. Perhaps small evergreen and ligneous plants are the next most easily dealt with, from the facility of giving them partial protection; and the most difficult, as is apparent, of all plants to aid in this way, are forest trees, which, if not planted within natural protection, such as mountains or hills, or thoroughly suited to climate and circumstances, perish, and that wholesale.

Amongst the smaller evergreens which I referred to—though some of them attain a considerable size—I would call particular attention to a few of which I have specimens on the table here; because their foliage and general appearance strikingly contrast with most other plants which we ordinarily see out of doors, in this country, and because they seem especially suited for town and suburban culture. I name, in particular, the variegated *Yuccas*—*aloefolia*, *filamentosa*, *quadricolor*, and *Stokesii*—all of which somewhat resemble each other, and all of which are beautiful, and hitherto comparative strangers in Ireland, except under glass. The *American Aloe*, *Agave Americana*, is everywhere to be seen; but few amateurs, I believe, have proved how easily it may be managed as a permanent out-door ornament. Last week I measured one of two companion plants, a green and a variegated one, which have stood for fifteen years, at least, at Cabinteely, in front of Mr. Jessop's parlour window. That which I measured is five feet high, and nine from tip to tip across the leaves, and in circumference round the extremities or tips of the leaves is more than twenty-seven feet. Covering of single bass matting, supported with stakes, and put up about December, is the only artificial protection either of these plants has received, and they are most vigorous.

Though, probably, the *New Zealand Flax*, *Phormium tenax*, is known in every county in Ireland, it is not nearly as common as it deserves to be. It may have flowered in many places; but I know only a few here where it has flowered and seeded—at Temple Hill, in Sligo county, and at Judge George's, on the Wexford coast, and in our own county Dublin. As yet, the variegated variety, and that called *Cookianum*, are expensive, but well worthy of attention. But, of all this class of foliage plants, those by which I expect soonest to have much additional ornament are the *Cordylines* of New Zealand, and other southern islands. You see a specimen on the table, in perfect vigour, which has never been a night under cover since it grew from seed brought by a friend of mine, Mr. Crosby Ward, from New Zealand, and raised on the banks of Lough Strangford. One, at least, of those seedlings is now nearly four feet high, and several of them have stood for years in exposed places, near Bangor, Killinchy and Killileagh. I believe they attain twelve feet in height, and at home they throw up a greenish-white fragrant flower from the top of the plant, like Yuccas. Several of these plants have stood, unprotected, twenty degrees of frost in this country; but what continuance of such cold they would endure I cannot say. I see some persons here—as good judges of a plant's beauty as any with whom I am acquainted—and before whom I do not hesitate to say, that the species of Cordyline named *indivisa*, if, as I expect, it stand out with slight protection, will prove in Ireland an ornament of imposing beauty.

Another family whose foliage is peculiar and very ornamental, to which I invite attention, is that of *Aralia*. *A. Japonica* has bloomed the last sixteen or seventeen autumns in Dr. Stokes' garden, in Merrion-square; and one which I brought to Dr. Croker a few years ago flowered in his garden here last autumn. *A. Siebaldii*, of which you see a specimen before you, has borne some winters near Edinburgh; and this winter four young plants are as yet uninjured in my own garden. The most showy species which I have seen in this country is *A. papyrifera*.

I know not how many varieties of Palm will bear our mild winters without protection; but I feel satisfied that there are several which can easily be managed with partial protection through our most trying years. Plants of *Chamærops humilis* and *excelsa* are still quite unhurt in Merrion-quare; and one of the former species has, with slight protection yearly, borne forty-seven winters in the Edinburgh Botanic Gardens. Dr. Moore recently procured a splendid specimen of this Palm, doubtless a distinct variety. Its height is over twelve feet. It was for many years in what was once a greenhouse, but where of late it has had but nominal protection. The crown is full of fruit, and a visit to it would encourage any one with taste to look out for varieties of this nearly hardy exotic.

I find our Dublin nurserymen introducing many of these and other such plants, of which time allows me to name but a few—such as *Areca sapida*, from New Zealand; *A. Baurii*, from Norfolk Island; *Corypha Australis; Juba spectabilis*, from Chili; *Phœnix tenuis* and *P. reflexa*, Cape of Good Hope; *Cerioxilon audicoli*, from the Andes; *Chamærops Fortuni*, China; *C. Martiana; C. Khasiana*, from Nepaul; *Seaforthia elegans.*

Early in this century crimson and other *Rhododendrons* created, I believe, a sensation in the gardening world of that time, which was limited compared with ours. Some of the most splendid Hybrids now stand the severest Scotch winter, and bear the scatheful blasts which swoop up the Princes-street gardens.

Within the last three years several have been planted in your lawn and in Merrion-square, and the bloom they have already shown is quite enough to encourage us in their further introduction.

Few persons who of late have visited any public Botanic Garden are unacquainted with the noble tree ferns of Australia, of New Zealand, and elsewhere, some of which have borne uninjured several degrees of frost in houses without further artificial heat. This family alone afford an exhaustless field of experiment and enjoyment—from those exotics to our own Killarney fern, which flourishes under glass even in a gloomy room in a foggy city.

In coming to a close, I will but mention the splendid Pines, and other forest trees, which California, China, Japan, New Zealand, and other countries, with the untiring perseverance of such men as Fortune, Douglas, and Robert Brown, have given to ornament this country.

And now, though I have but glanced at our exhaustless subject, time tells me to stop. In every art and science, each corner of the domain of knowledge would exhaust the labours of generations of observers: we are taught that a life of toil might be baffled by the problems to be found in a drop of turbid water; and generations of observing thinkers might fail before all that science may reveal in a withered leaf could be learned. But there are branches of learning we all should study, and which we need for daily use—how best to foster and preserve our bodily and mental vigour, and to make our Christianity practical, and not merely theoretic; and for these we require every help within our reach.

For centuries Ireland, with all her infirmities, was recognised as the Island of Saints; and I believe history points to no six millions of people together in any country who were so moral and religious as the present people of this country; and I may add, there are none other more easily governed by wise and upright rulers. If this country were fitted in the dark ages to foster and diffuse Christianity on the Continent of Europe, the purifying process which her Churches are undergoing seems to be fitting her to carry the principles of civilization, and the practice of Christianity, to the farthest corners of the world. With many checks, civilization has continuously advanced for nearly six thousand years—often in unlikely channels; and learned and implicit believers in Scripture tell us, that for previous ages man made considerable though but infantile advance. Notwithstanding many gloomy forebodings which we daily hear, I read of no period when the stream of civilization proceeded more rapidly, and perhaps more smoothly, than our own. Recreations must be given to the masses suited to altered and altering times. Gladiatorial shows of semi-barbarians, or the bull fight of half-civilized people—even the hunt and the race-course—are not enough to satisfy the expanding minds of our working orders. From the Ward case at the invalid's couch to the pine forests on our mountains—from the Cedar of Libanus to the Hyssop that springeth out of the wall—the culture of plants has ever enlarged its field the more its study is pursued; and no other branch affords so high employment to the mind as that which you have allowed me to speak of this evening.

XLIX.—*Report on Experiments made in* 1869, *with the Japanese Silkworm, Bombyx Yama-maï.* By A. G. More, M.R.I.A.

Experience having shown that no great success could be expected from rearing these silkworms within doors, as the larvæ in this case usually die off just as they have attained their full growth, and before they have begun to spin,* it was resolved, in 1869, to make a fresh trial—first, by raising some larvæ from eggs which had been laid in England, and which might, therefore, be considered partially acclimatized; and, more especially, by establishing some colonies in the open air, in the hope that the silkworms, being exposed from the first to the ordinary condition of the climate of Ireland, might, when they arrived at the critical period of growth, prove more hardy and better able to spin their coc oons.

---

* See Dr. De Ricci's remarks in "Proceedings of Royal Dublin Society."

On the 23rd of April, 300 English-laid eggs were received from Dr. Wallace. These were on the point of hatching, and, indeed, ten worms had already escaped from their eggs during the journey from Colchester; these were at once placed upon a small English oak (*Quercus robur*), that had been planted in a pot, and forced for the purpose; the pot was then placed in a cool frame, on the north side of a hedge, in a sheltered part of the Botanic Garden, at Glasnevin.

The worms continued to emerge from the 24th to the 30th of April, and, each morning, as fast as they were hatched, were lightly sprinkled with water, and then transferred to the forced oaks in the frame, or to some sprays of oak placed in damp earth in the same frame, on which they appeared to feed quite as readily. In order to keep the air moist and cool, the oaks and sprays were freely sprinkled every day with water, and the frame was kept only slightly open on one side. Under this treatment, the young worms commenced to feed heartily, and, by the 3rd of May many of the oak leaves were stripped to the midrib. The sprays of oak were changed every second day; and all the worms which had wandered from the forced oaks, or from the sprays, were placed together upon the fresh food.

On the 7th of May, some of the worms were attacked with a black fæcal discharge, and a few others had shrivelled, but the losses up to this date were not great.

On the 8th of May, two lots of twelve and fifteen larvæ were transferred to an English oak tree, in the open air, the branches upon which they were placed being enclosed in large muslin bags. By the next day, these worms had begun to eat freely; the temperature being about 45° in the daytime, with a north-east wind, and cold at night. At this date I had to leave them, in order to superintend the operations at Killarney.

May 20.—On returning to Glasnevin, I found the larvæ in the frame much grown, being about three-fourths of an inch in length; and on the 21st forty more were put out in four net bags, on an another English oak, in the Botanic Garden, leaving fifty-six to be reared in the frame.

At the beginning of June, the worms out of doors were doing well, and appeared to be as well grown as those inside the frame.

On the 20th of June, only twenty-eight worms remained alive in the frame—one-half having died during the past four weeks,—whereas the worms which were being reared in the open air had done better, and continued to feed well.

At the beginning of July, the worms in the frame had attained a large size, but were dying off fast, some being covered with small black spots, and others unable to change their skin.

On the 7th of July, only sixteen worms were found alive in the two bags which remained on the oak trees, the other four bags having been carried off by some inquisitive or mischievous person; but these larvæ, which had been reared in the open air, though smaller in size, seemed more active and hardy than those in the frame. On the 14th of July only three worms were alive in the frame, and eleven out of doors.

On the 19th the last two worms in the frame died, and only eight were alive out of doors, and these ultimately produced a single cocoon only, in which the worm died without changing to a chrysalis.

Thus the trial of English-laid eggs failed; but it must be said that they nearly all proved fertile, which is far from being the case with even the best eggs received from Japan.

Mr. Herbert having kindly given permission for the experiments to be carried on within his demesne, at Muckross, I proceeded, on the 11th of May, to Killarney, taking with me a supply of eggs received from M. Guerin Meneville, and a small quantity which Dr. De Ricci had obtained also from Paris; these eggs had been kept through the winter in a cool, dry cellar, and at the time when I started no worms had appeared in either of the two parcels. On arriving at Muckross, I placed these eggs, after moistening them under glass funnels, in a frame, at the temperature of 60°; but, although treated with great care, nearly all the French eggs proved barren, so that, ultimately, I had to depend almost entirely upon a fresh supply, which arrived from Dr. Wallace, on the 13th of May, and, being kept in a warm room, immediately commenced hatching at the rate of about fifty larvæ per day. These worms were placed out of doors from the very first, the temperature being about 48° at nine o'clock, A.M., with occasional showers of rain, and a south-east wind. Each morning, after allowing the newly-hatched worms about half an hour to drink from a plate of glass sprinkled with water, I swept them gently into two small net bags, containing each about twenty-five larvæ; and then, with the assistance of Mr. Counihan, the obliging gardener at Muckross, these small bags were pinned to the tenderest leaves on the under side of a bough, which was then itself enclosed in a large bag. The young larvæ soon made their way out of the small bags, and by the next morning were generally to be seen scattered and feeding upon the nearest leaves. I also found it a good plan to brush the young larvæ from the wet glass, simply on to a strip of damp muslin, which was then transferred to the oak spray, and from which the worms seemed to find their way more easily than from the bags.

In this manner about a dozen colonies of the silkworms were established upon different oak trees, in the most sheltered and shady places that could be found; and at the time when I left Killarney, on the 19th of May, they seemed to be doing well, although a few of the more weakly worms had died.

Mr. Counihan, who from the first had taken great interest in the success of the experiment, continued to report progress at frequent intervals; and, from his letters it appears, that at the end of May the silkworms had suffered considerably from the weather, which had been very unfavourable, and unusually cold for the season. Eight or nine worms only were left in most of the bags; these appeared healthy, and had still plenty of food; from seventy to eighty were still being hatched each morning, and these, as they appeared, were transferred by Mr. Counihan to the most tender branches that he could find.

On the 15th of June the worms were growing well, and had been shifted to fresh branches; there had been very few losses since the commencement of the month; the weather still continued cold.

On the 5th of July Mr. Counihan reported some deaths, but not from want of food, as he had again moved most of the bags to fresh branches. During the remainder of this month, the worms decreased in number; and in August they died still more rapidly, so that, in spite of every care and attention, Mr. Counihan, in the end, obtained only two perfect cocoons in September, and in both of these we found that the worms had died before changing to the chrysalis state.

So far, the out-of-door experiment cannot be considered a success; but, at least, it will be seen that the three cocoons obtained, one at Glasnevin and two at Killarney, were all produced by worms reared in the open air; and, at Killarney, the weather, at first too cold, and afterwards very dry and hot, presented conditions more than usually unfavourable.

L. — *Suggestions for the Organization of Co-operative Farming Associations in Ireland.* By JAMES HAYES, C. E.

[Read Monday, March 21, 1870.]

THE principle of co-operative association, as applied to distribution, has been wonderfully developed in England within the past ten years.

There are at present in England and Wales no less than 600 societies registered under the Industrial Society's Act, having over 200,000 members enrolled, with a subscribed share capital of about two millions sterling.

Some of these societies have already directed their attention to production, and have established in Lancashire and Yorkshire cotton and flour mills of a very superior character.

But the principle has not as yet been generally applied to production. It is, however, but a question of time, as the industrial classes of England—particularly of the north—are fully alive to the economic value of the principle. They have lately established a federation of the societies in the north. By means of this organization the cost of the service of distribution has been reduced to a minimum of a half per cent.

It is not too much to say that the future industrial progress of the United Kingdom depends very much upon the development of this principle of co-operation, applied to both production and distribution.

England affords but two instances where co-operative association has been and continues to be applied to farming. And these are mere modifications of the principle, the chief element—the union of capital and labour in the same persons—being absent.

It is only within the last few years that the law was altered so as to admit of co-operative associations holding more than *one* acre of land. As the law previously stood, it was impossible to apply the principle in its integrity to farming operations. This may, to some extent, account for so few instances of such undertakings.

Neither of the societies referred to—if they may be called societies—originated spontaneously with the people themselves. The first was started some thirty-five years ago, by John Gurdon, Esq., of Assington Hall, Suffolk, on his property at Assington.

He called together a few labourers of good character and intelligence, and offered to let them a farm then on his hands, and which had previously been badly cultivated. He also offered to find the requisite capital, by way of loan, provided they paid down £2 a head as guarantee, and agreed to his rules, which were simple, and suited to the circumstances. Twenty labourers united, and agreed to accept Mr. Gurdon's very liberal offer. The farm consisted of 100 acres, with which a lease was given.

In the course of ten years the capital was all paid back; and so successfully had the plan worked, and so well satisfied was Mr. Gurdon with it, that he let them another farm on the same terms.

There are now 55 members, and they hold 336 acres; but only 20 members are working this land, the others being employed elsewhere. Their shares are worth £50 each, which would become forfeited in the event of the holder being convicted of crime. So satisfied does Mr. Gurdon feel with the operations of his humble co-operative tenants, that he recently declared he would still extend the plan.

The other case is somewhat of a different character, and of more modern date. This proposal also originated with the landlord—a most intelligent, enterprising gentleman—William Lawson, Esq., brother of Sir Wilfred Lawson, M. P. for Carlisle—a gentleman who has made modern scientific farming his study and business. He had in his own hands at Blenerhasset, near Carlisle, two farms of 500 and 300 acres, upon which he had expended a large sum of money in permanent improvements, and in furnishing appliances of every kind suitable to the requirements of the high-farming system he had adopted.

About six years ago he called a meeting of his labourers, and intimated to them his intention to go abroad for some years; that he had matured a plan whereby they could become participators in the profits of the farms, besides receiving their wages, which amounted in the aggregate to over £2000 a year. The proposal appears to have been as follows:—

A competent and disinterested party should make an accurate and detailed valuation of the farms, with their crops, stock, and implements, &c. A fair rent was fixed, and a contract was to be entered into, binding the parties to pay that rent, together with a certain proportion of the profits made in the year after all expenses were discharged, which was called "wages of capital."

The experiment, though apparently a hazardous one, I have reason to believe has proved quite successful.

Although these two cases can hardly be cited as examples of co-operation in its strictest sense, yet they appear well worthy of consideration by all who sincerely desire the welfare and social improvement of the agricultural labouring classes.

Almost every traveller of note, who has favoured us with any account of the domestic institutions of the people of Switzerland, has noted the co-operative associations of the small farmers in the cantons of Geneva, Salzall, Zurich, Basle, de Vaud, and others.

These intelligent people appear to have applied this principle of co-operation to almost every department of rural economy. The making of cheese, the growth and sale of fruits, of milk, of butchers' meat; assurance against fire, mortality amongst cattle, aud the purchase and hire of expensive machinery and implements of husbandry. In short, Switzerland has taught us how agriculture can be united with manufacturing industry; and how small farming, by the application of the principle of association, can be made to compete successfully with the rival system of modern high farming. The small farmers of that country, if left to themselves with their five or six cows, could not more than our own small farmers produce marketable cheese. Yet they do manufacture cheese on a large scale, and of a superior quality. The Parmezan cheese, which is so much esteemed for its quality, and which sells at about 2*s.* 6*d.* per lb., is made at co-operative dairies owned by small farmers. In the district where this cheese is made, between Lodi and Cremona, in Italy, the small farmers who supply the milk, stall-feed their cows winter and summer.

In the United States I have myself witnessed some most remarkable instances of the successful application of this principle of co-operation to the cultivation of the land.

In Michigan, the *Shakers;* in Connecticut and New York States, the *Communists;* and in Illinois, the Germans, have all been most successfully engaged in almost every variety of agricultural co-operation.

The final end of our civilization, in an agricultural point of view, ought to be to support upon a given surface of a given fertility the greatest possible number of persons. This amount of population has its limits, varying with the times and the progress of the arts. Of course, *when* the redundancy arrives, it should have an outflow; an emigration should *then* take place towards countries where the forces of nature, inactive, claim the hands useless elsewhere. But that is not our present condition.

Notwithstanding the vast efforts made during the past quarter of a century to establish a system of large farming by the consolidation of numerous small holdings, Ireland is still a country of small farms. The holdings between 5 and 50 acres in extent number 381,000, as against 86,000 exceeding 50 acres. Our small farm system is therefore a great fact; and I think we should by all means strive to reconcile it with the progress of our ideas.

It is urged—on what grounds it is difficult to comprehend—that cultivation does not pay; that the conversion of tillage lands into pasturage affords the surest means of profit to the farmer. And that, in order to extend that advantage, it is necessary to consolidate the small holdings until the average size shall reach about 100 acres.

Such a doctrine is not only fallacious, but downright wicked and mischievous. Even if it were desirable, let us understand it is no longer practicable to exterminate half the agricultural population of the country.

That our system of rural economy is defective there can be no doubt; but to say that it cannot be improved except at the cost of uprooting the people, and turning the tillage lands into pasturage for cattle, is perfectly monstrous.

The soil of Ireland, for the most part, is capable of yielding any description of crop, properly cultivated. Yet more than half the arable land of the country is now under permanent pasturage, supporting, comparatively, a small amount of stock in proportion to area and the natural fertility of the soil. There can be no doubt whatever but the same extent of land under a system of mixed husbandry would yield far greater results. At the present moment, the value of our exports of live stock—the chief business of the country—barely covers the cost of our imported bread stuffs. The figures for 1867, as given by Thom's Directory, are—Cattle exports, £8,758,018; bread stuffs imported, £8,415,358; the balance in favour of exports being only £332,660.

It is a singular and most anomalous thing to see a country so essentially agricultural as Ireland is obliged to import bread stuffs for her own people.

In the southern counties, where dairy farming chiefly prevails, and which embrace the richest tracts of land—which have borne the most luxuriant crops ever seen—the proportion under cultivation is continually diminishing.

Every possible encouragement should be extended to the system of mixed husbandry, which experience and common sense proclaim to be most suited to the circumstances and requirements of this country.

Doubtless, the influence of extraordinary high prices for cattle and butter, owing, among other things, to the Cattle Plague, induced the farmers of the south latterly to turn their attention altogether to grazing. But it is open to grave doubt whether this general abandonment of cultivation will be of permanent benefit to them. Then the tendency of the grazing system is admittedly unprogressive and uncivilizing, and must give way before superior intelligence.

Compared in money value results, mixed husbandry yields over 41 per cent., or £163 per 100 acres, more to the general wealth of the country than the grazing system does, according to the *Irish Farmers' Gazette*, which has based its calculations upon the agricultural statistics. This in itself should justify doubts as to the propriety of encouraging the extension of pasturage, which necessarily leads to the destruction of the people by the absorption of their holdings.

Instead of seeking to "disestablish," so to speak, our small farming, we should by all means endeavour to preserve it. And with that object we should direct the attention of the people to the principle of co-operation, which alone can reconcile small farming with the progress of agriculture. The spirit of co-operation is inherent in the Irish character. Let it be intelligently directed to the development of the resources of their farms, and you will have a peaceable, happy, and contented people.

Though the scheme proposed is applicable to any part of Ireland, it is considered more desirable to identify it with a particular district. The barony of Clanwilliam, in the county Tipperary, and the adjoining barony of Small County, in Limerick, are for the most part occupied at the present day by dairy farmers in the production of butter. These baronies comprise some of the richest and most fertile lands in Ireland called on that account the "Golden Vein." They contain altogether 160,385 acres, 137,000 of which are rich arable, but only 43,900 acres are cultivated, the larger portion 93,100 acres being under permanent pasturage. The holdings number 3357, if we exclude those at and under 1 acre in extent. On these holdings there are 26,250 cows; giving an average of about 8 cows to each holding, and to each cow an average of about 5 acres of the arable area; taking no account of the non-arable (23,000 acres), which are by no means useless for grazing. This rich and fertile land does not, therefore, appear to be overstocked.

The agricultural statistics, though very valuable, are incomplete without some returns showing the quantity of marketable butter produced in each county. Also, in order to ascertain how far we may be progressing in improved methods of culture, it would be very desirable to take cognizance of the number and character of the agricultural implements and machinery in each county. The additional expense to obtain such extra returns could not be much, compared with their value and importance to the public. The butter produced in this district amounts to about 100,000 firkins, value for about £300,000 per annum.

It may be confidently stated, notwithstanding the favourable character maintained by the butter makers of this district. that this quantity of butter could be increased in value by improved methods of manufacture, at least 5, or probably 8 to 10 per cent.

The country probably loses annually about 1½ millions sterling through want of proper skill in butter making. The mere change of a dairymaid often produces the most marked difference in the quality of the butter made on a farm.

The difficulty of procuring good dairymaids and of retaining them is now very great. The farmers are often complaining of this, and not without reason. The explanation for this scarcity of dairymaids is, that as soon as they save sufficient money they emigrate to America.

The manufacture of cheese and condensed milk, which yields high returns is almost wholly neglected. It is true that an English company has recently been established at Mallow for the manufacture of "condensed milk," which has hitherto been imported from America or Switzerland. It is certainly not creditable to our enterprise to have entirely neglected such a lucrative trade, and left it to an English company to establish. There is an erroneous notion prevailing that our rich lands are not favourable for cheese. But this may be set down as a popular fallacy. Very superior cheese—equal I believe to any Gloucester cheese—has been extensively made, and still continues to be made on a limited scale, in the county Tipperary, as also in other parts of Ireland.

Mr. Thompson, an English gentleman farmer, residing at Barnane, near Templemore, who came there from Derbyshire, was extensively engaged in cheese making after he settled at Barnane. But, though his produce was equal to any he had made on his farm in Derby, he could not obtain a market for it in this country. He had, therefore, to send it to the cheese markets of England at considerable cost. Of course, this was by no means encouraging; and accordingly we find Mr. Thompson discontinued the business. But, independent of this, he suffered great mortality amongst his dairy cattle; and this, added to the want of home markets for his cheese, induced him to abandon dairy farming. Mr. Thompson, however, does not say that cheese making in Ireland is practically difficult. What he says on this subject is this, and his testimony is valuable:—

"I have not the slightest hesitation in saying that cheese making would pay well in this country. I found it easier to manage than in Derbyshire. In fact, it was very much like moulding bricks. The cheese I made here was in every respect equal to the Derbyshire cheese, and I was paid 70*s.* per cwt. (120 lbs. to the cwt.) for it in Derby. That was about 4*s.* per cwt. over the average price of the Derby dairies for that year; but the carriage cost me about 3*s.* 6*d.* per cwt., besides other charges. I found, where I could produce one firkin of butter, the produce of cheese was 1⅝ cwt., and that at 70*s.* is equal to £5 12*s.* 6*d.*, whereas the firkin of butter only fetched £4. As far as my experience goes, any land producing butter is also adapted for cheese making. When I first came here, we had plenty good dairy girls, but most of them have emigrated; and perhaps, if I were inclined to resume cheese making again, I should find some difficulty in procuring a class of girls so easy to train to the business as those I formerly had."

This I consider very important evidence, coming as it does from a gentleman of Mr. Thompson's large practical experience in England and Ireland.

The want of home markets for the productions of the country must necessarily militate against them. Had there been a cheese market in the county Tipperary, in all probability not alone would Mr. Thompson have continued to make cheese, and have kept the dairy girls from emigrating, but numbers of other farmers would have entered into the business. But it is to be hoped we shall be able to find means of overcoming this difficulty.

The most generally striking defect of our dairy management is the absence of properly constructed dairies. The bed chambers are not unfrequently the only places where the milk is set to cream, and butter is stored. Need we wonder, then, that butter so treated should be depreciated in the markets? But, after all, it is hardly fair to throw the entire blame of bad butter making upon the poor farmer. In the generality of cases he is a mere tenant at will, and has no security for laying out money in fitting up a proper dairy, which he knows perfectly well is needed in order to carry on his business with profit and credit to himself. Unfortunately, every interest suffers from this unsatisfactory state of things. Let us, however, trust that these anomalies will soon disappear.

Perhaps the suggestions here offered may point out a means of obviating the necessity for building new dairies on many small holdings where they are now needed.

From personal acquaintance with the district referred to, I calculate that two-thirds at least of the holdings now require improved dairy accommodation. And if we estimate the cost at £25 as an average for each holding, it would necessitate an expenditure of about £67,000 for this purpose alone. The amount is sufficiently large to justify the consideration of how much of it might be saved through the adoption of the co-operative scheme. This is a consideration which equally concerns landlord and tenant.

This proposal involves a total change in our existing dairy system.

The business of butter, cheese, and condensed milk manufacture should be separate and distinct industries, altogether apart from the households of the farmers, conducted by skilled hands, located in central establishments, built specially for that purpose.

The farmer should be free to attend more effectually to his land to increase its cultivation, and to produce a better system of feeding and general management of his stock. The milk of his cows should be delivered over to the co-operative dairy for conversion into marketable products.

By this means a better division of labour, more economy, superior qualities, and greater varieties of valuable products would be obtained. Under this new order of things new industries would spring up, and old ones would revive. Having thus indicated the general scope of the measure, we shall proceed to develope its details.

This, of course, is but a rough outline of the plan, but I claim for it the advantages following:—

1. It will favour a more economic division of labour, and therefore diminish the cost of production.

2. It will admit of the economic employment of machinery to small farming.

3. It will afford facilities for establishing rural industries, now neglected.

4. It will stimulate the demand for labour, thereby mitigate the evil of emigration.

5. It will improve the moral and social condition of the people.

6. It will give a stimulus to tillage, and thereby improve our agriculture.

7. It will improve the quality, increase the quantity, and enhance the value of our dairy products; and thereby add to the general wealth and prosperity of the country.

8. It will bring the interests of producers, distributors, and consumers into more perfect harmony with each other.

9. Finally, it will reconcile our small farming with agricultural progress, and give securities for peace, law, and order.

It may be said that this proposal is somewhat too novel; or, that the agricultural mind is so dense that it cannot be penetrated with a new idea.

I admit that this phase of co-operation is a novelty to us; but so much the worse for us it should be so.

I do not, however, admit that the farming classes cannot appreciate the value of a new principle when it is properly placed before them.

I have reason to believe it is the other way: that when an intelligent proposal, affecting even remotely their self-interests, is shown to them to be practically feasible, they are not slow to adopt it. I may instance a case which corroborates this statement:—

An intelligent gentleman, an agent over a large property in the South of Ireland, had long observed how much the small farmers in his neighbourhood needed co-operation among themselves in order to obviate what he considered an improvident waste of their time.

This was exemplified in the practice of each small farmer taking a horse and cart a long distance to market, with, perhaps, only one or two firkins of butter each for sale.

He often beheld twenty or thirty of these small farmers with their yokes about the local butter market at the very time, perhaps, when their labour was much needed at home. It struck him that this was a real blunder, but one that was capable of being very simply rectified. He spoke to them on the subject, and pointed out a way of remedying the matter. He suggested the propriety of their selecting one or more of their number in whom confidence could be placed to take their butter to market, and dispose of it, and thus save their own and their horses' time and labour. Fortunately there was no difficulty in finding honest men among them; and I am happy to say the suggestion was carried out, and has been productive of the best results.

There is really no indisposition on the part of the people to cooperate together when they have a direct interest in so doing.

The difficulty rather lies in giving direction and force to a movement of this kind; and in establishing an organization that shall be safe to work with.

My plan may not be a perfect one, neither do I offer it as such.

But, such as it is, I humbly submit it to your consideration. If there be anything valuable in it, this Society, I am sure, will be able to discern its importance.

I have myself a thorough conviction of the value and importance of the co-operative principle. I believe it is the great lever of modern days for elevating the people in the social scale.

I feel it a great honour and advantage to have been permitted to bring this subject for discussion before so influential a Society, and a tribunal so well qualified to judge of the merits of any proposal having reference to the progress and prosperity of the people of Ireland.

HOW TO DEVELOPE THE PRINCIPLE.

1. An Association registered under the provisions of the Industrial Societies' Act, with limited liability, to be established with shares of £1 each. Each farmer shareholder to hold for each cow in his *bonâ fide* possession one share.

2. The capital to be applied to the building and maintenance of a sufficient number of dairy stations, containing every needful appliance requisite for carrying on the business properly, with sufficient land for the use of the establishments; also to the erection and maintenance of a central *depôt*, stores, and milk shops.

3. The industries conducted at these dairy stations shall consist of the butter, cheese, and condensed milk manufactures. Steam power, and every modern improvement that science or art may suggest for efficiently working the business, shall be adopted. The principle may be developed gradually by a small number of farmers joining the undertaking at first. Then it would extend until it embraced the maximum number of farmers the district station or dairy could accommodate.

4. Dairy stations to be erected in convenient positions, having regard to the efficient collection of the milk from the farmers. The positions will be best determined by the character of the country and the accommodation of roads in the district over which it is proposed the vans or waggons collecting the milk shall travel in a given time. Of course it will be desirable, on economic grounds, to embrace the largest possible number of farms in the collection of a district. But the extent of the dairy district will depend upon various circumstances, which must be carefully considered.

5. The dairy stations shall have accommodation for the rearing of calves and pigs, and, if necessary, an infirmary for sick cattle belonging to shareholders. There shall also be a forge, where shareholders will have their work done upon moderate terms, according to a fixed tariff to be agreed upon. An assurance against mortality of cattle might also be adopted.

6. In connexion with the dairy stations, and forming part of the working plant of the establishment, should be a certain number of light running spring waggons or carts, for the purpose of fetching the milk from the farms to the dairy stations. Proper vessels, of a uniform pattern and size, should be provided for that purpose. The waggons

should be in charge of intelligent and trustworthy men, who would be entrusted to receive the milk, and enter the quantity in proper passbooks provided for that purpose.

7. The mode of estimating the price to be paid for the milk supplied should be by ascertaining the average annual value of the milk of an average cow converted into butter ; the price of the butter being ascertained from the general average price paid at the local markets for, say, the last five years. This might, perhaps, give an average price for the milk of from 3*d.* to 4*d.* per gallon, or its equivalent value per pound weight, which might be more satisfactory. The difference between pure milk and watered milk can be ascertained by weight—pure milk being 2lbs. per cubic foot heavier than water; the latter weighing 62·4 lbs. per cubic foot, while milk weighs 64·4 lbs.

Whatever the price may be, it shall be paid to the farmer weekly, either in cash or in the society's circulating medium called "checks," which can be exchanged at the store for goods purchased.

8. There shall be a large central depôt established in a proper position beside a railway. The butter and other products of the dairy stations shall be sent to this depôt regularly. It will become a market where shippers will frequent in preference to other markets, owing to the superior quality and high character the goods are certain to obtain. But, in order to bring the producer still nearer the consumer, distributive stores in connexion with the depôt shall be established in Dublin, London, Liverpool, and Manchester, if found necessary.

9. The depôt will maintain a cooperage for the manufacture of firkins and other needful articles, which shall be of uniform pattern, materials, and weight, and carry the society's trade mark and brand. This depôt will embrace productive and distributive departments, and shall be in charge of an efficient, experienced, and trustworthy officer. Everything requisite for each department shall be properly stored in this depôt.

10. The distributive department shall embrace groceries, provisions, implements, portable manures, and feeding stuffs for stock; also seeds of various kinds, and of guaranteed qualities. Certain classes of machinery will be also maintained for loan or hire, at a fixed tariff.

11. This department will be conducted on the pure co-operative principle, now so well understood and appreciated in England. To purchasing shareholders only will the profits (except on capital) of this department be given, and then only in proportion to their purchases during the quarter.

12. The productive department shall be concerned with the disposal of the manufactured goods of the society; the loaning and hiring of implements and machinery; also of agricultural products raised on farms of shareholders consigned to the depôt for sale on commission or otherwise; as also of the stock raised by the Society or acquired by exchange or purchase. The profits made by this department out of the products of milk shall be awarded to each dairy station in proportion to the value of the manufactured articles contributed during the quarter; this to be distributed in dividends proportioned to the value

of the milk supplied. Suppose the dividend declared to be 6*d.* in the £1. That is understood to mean, that for every £1 worth of milk supplied by each shareholder he will be entitled, in addition to the amount already received for milk, besides the dividend of 5 per cent. on his capital account, a sum of 6*d.* for every such £1 worth of milk delivered and credited to him during the past quarter, or 2½ per cent. additional. As regards the remaining profits, if any, arising from the sale and hire of implements, commission on sales, traffic in stock, insurance of cattle, manufacture and sale of firkins, they shall be added to the capital of the society, or for the creation of special or reserved funds.

13. The capital of the society shall bear interest at the rate of 5 per cent. per annum, payable yearly out of the profits of the Society. The interest may be allowed to accumulate, in order to create further shares in the society, if any member so elects.

14. The accounts of all departments shall be made up and properly audited every quarter. A balance sheet, setting forth in full and ample detail the affairs of the society for the past three months, shall be prepared and presented to a properly convened meeting of shareholders once a quarter.

15. The society shall be managed by a board of directors, elected by the shareholders. A certain number of Directors shall be elected for each dairy district, being shareholders; and a committee, consisting of one representative from each dairy station, might be chosen to superintend and direct the central depôt.

16. Shareholders proved guilty of dishonest and fraudulent practices, prejudicial to the interests of the society, to have their shares forfeited, and be expelled the society.

LI.—*On some of the Results of Spectrum Analysis, as applied to the Heavenly Bodies;* being the Substance of a Lecture delivered before the Royal Dublin Society, on Saturday, March 15, 1870. By WILLIAM HUGGINS, LL. D., D. C. L., F. R. S., Hon. Sec. R. A. S.

THE lecturer said that, in the present Lecture, he purposed to describe some of the more important results of the application to the heavenly bodies of the new and remarkable method of analysis which within the last few years has added so largely to our knowledge of nature.

Spectrum analysis, which does not require the observer to come into immediate contact with the bodies to be examined, but is founded on an interpretation of the luminous radiation from them, has not only placed in the hands of the chemist the power of detecting substances, under certain conditions, with a degree of delicacy far greater than that possessed by his ordinary tests, but has revealed to him the presence of four new metals—thallium, cæsium, rubidium, and indium.

It is, however, in its application to the heavenly bodies that this elegant instrument of research has produced the most remarkable results. Peculiarly adapted to the needs of the astronomer, since the only requisite is light, it matters not from how distant a source the light has come, nor how long it has been upon its way, the spectroscope places within his reach certain knowledge on many points, on which before all he could hope for was a probability of conjecture. The chemical nature, the physical state, within certain limits the temperature and the density, and the motion on the line of sight of the most distant parts of the visible universe, can now be investigated in the observatory; and in respect of some of the heavenly bodies, considerable knowledge on these points has been already obtained.

As the time allotted to one lecture is much too short to describe fully all that had been accomplished by spectrum analysis, the lecturer said he should describe for the most part researches which had been carried on in his own observatory, passing briefly over the earlier results, in order to be able to enter into more detail respecting recent observations.

The prism enables the eye to see in succession, and so to discriminate the different kinds of light which, without the intervention of the prism, would fall simultaneously upon it, and be lost in a compound impression.

The different kinds of light present in the radiation from a luminous body, when they are made visible to us in this way, constitute the *spectrum* of the luminous body.

The spectra of all bodies rendered luminous by heat may be classed under three types:—

1. A spectrum in which light of all refrangibilities is present, from the lowest red to the highest violet of which the eye can take cognizance. Such a *continuous* spectrum shows that the luminous source consists of highly heated matter in the *solid or liquid* state.

2. A spectrum consisting of light of some refrangibilities only. Such a spectrum of *bright lines* indicates that the heated matter from which the light comes is in the *gaseous* state. As each gas and vapour emits a set of lines peculiar to itself, it is possible to learn if any substance with the lines of which we are acquainted exists in a distant source of light.

3. A continuous spectrum, in which there are gaps formed by the absence of light of certain refrangibilities. These dark lines are produced by the absorption of gases or vapours at a temperature lower than the luminous source through which the light has passed. As these dark lines are of the same refrangibility as the bright lines which the same gas would emit when luminous, it is possible to learn the chemical nature of the gases or vapours through which the light has passed.*

---

* The few apparent exceptions to these general statements are so unimportant as not to interfere with their application to the appearances presented by the light of the heavenly bodies, when examined in the spectroscope.

Kirchhoff, the great founder of this elegant and powerful method of research, applied his own method to the sun, and gave to us the first *certain* knowledge of the nature and constitution of that body. He showed that it consists of intensely heated matter, of so high a temperature, that magnesium, zinc, nickel, iron, and other metals can exist there only in the state of vapour.

The further knowledge we have gained of the state of things in the sun from the spectroscopic observation of the red flames will be studied with more advantage after the consideration of the observations which had been previously made of the other heavenly bodies, and which contributed greatly to the success of the recent researches on the sun.

This was the state of the newly-born science of celestial spectroscopy, when, in 1861, the speaker attempted the extension of Kirchhoff's method to the other heavenly bodies—an investigation which has been carried on in part in conjunction with his distinguished friend, Dr. W. Allen Miller, Treasurer, R. S.

Great difficulties presented themselves from the faintness of the light of the stars, and from their apparent rapid movement arising from the earth's rotation. There was exhibited on the screen a view of the lecturer's observatory, in which were seen the arrangements, consisting mainly of a large telescope moved by clockwork, by which these difficulties and some others were overcome.

The spectroscope, specially contrived for the purpose, is attached to the eye end of the telescope. By a suitably arranged mirror, the light from highly-heated terrestrial substances can be thrown into the instrument, so that their spectrum can be seen simultaneously, and side by side with that of the star. In this way the coincidence, or otherwise, of lines in the two spectra can be determined with great accuracy.

As the moon and planets reflect solar light, the investigation of these bodies was limited to any modification impressed on the sun's light, either by the absorptive power of their atmospheres, or by the nature of their surfaces.

All attempts to detect an atmosphere about the moon failed. Trustworthy indications of atmospheres, analogous to that of the earth, but not identical with it, were seen in the spectra of Jupiter, Mars, and Saturn. Uranus is probably surrounded with an atmosphere.

The fixed stars, since they shine by original light, afford in their spectra fuller indications of their nature. It should not be overlooked that we possessed previously no certain knowledge of these remote points of light, since it was on the ground of analogy alone they had come to be considered as suns. Spectrum analysis has shown that this opinion was true to fact, and that the stars are constituted similarly to our sun, and like it consist of intensely heated matter.

Photographs of drawings of the spectra of several stars were projected on a screen by means of the electric lamp. In these were seen the coincidences and relative positions of the dark lines of the stars with the bright lines of the elements which had been compared with them.

The results on the light of the stars, *Aldebaran* and α *Orionis* (*Betelgeux*) are given in the following table:—

Elements compared with Aldebaran.

Coincident.

1. Hydrogen	with	lines C and F.
2. Sodium	,,	double line D.
3. Magnesium,	,,	triple line *b*.
4. Calcium,	,,	four lines.
5. Iron,	,,	four lines and E.
6. Bismuth,	,,	four lines.
7. Tellurium,	,,	four lines.
8. Antimony,	,,	three lines.
9. Mercury,	,,	four lines.

Not Coincident.

Nitrogen,	three lines.
Cobalt,	two lines.
Tin,	five lines.
Lead,	two lines.
Cadmium,	three lines.
Barium,	two lines.
Lithium,	one line.

70 lines measured.

Elements compared with α Orionis (Betelgeux).

Coincident.

1. Sodium,	with	double line D.
2. Magnesium,	,,	triple line *b*.
3. Calcium,	,,	four lines.
4. Iron,	,,	three lines and E.
5. Bismuth,	,,	four lines.
6. Thallium ?		

Not Coincident.

Hydrogen,	C and F. (?)
Nitrogen,	three lines.
Tin,	five lines.
Lead,	two lines.
Gold ?	
Cadmium,	three lines.
Silver,	two lines.
Mercury,	four lines.
Barium,	two lines.
Lithium,	one line.

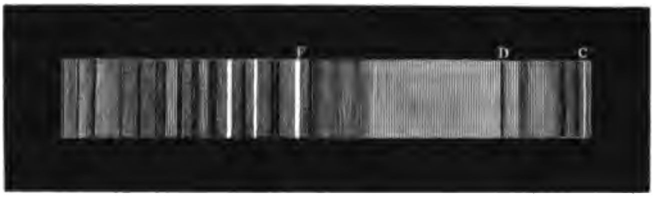
80 lines measured.

The 70 or 80 lines measured represent some of the stronger only of the numerous lines which are seen in the spectra of these stars. Some of these are due probably to the vapours of other terrestrial elements which have not been compared with these stars. It would be assumption to suppose that the 70 so-called elements constitute in its entirety the primary material of the universe. Doubtless in the spectra of the stars the chemist is introduced to many new elements—would that it were possible for him to recognise and to isolate them!

About fifty other stars have been similarly examined. It is not unworthy of notice that some of the elements which are essential to life as we know it, and which would be most easily recognised in the spectroscope—namely, hydrogen, sodium, magnesium, and iron—are the elements which, with few exceptions, appear to be universally present in the brighter stars by which we are surrounded. Whether there are star strata in which other groups of elements, or elements new to us prevail, is a question which it may not be perhaps altogether beyond the power of the spectroscope to decide.

It was shown by the spectra exhibited on the screen that in the case of coloured stars the colour was due to the arrangement of the dark lines in the spectrum (depending on the temperature and chemical constitution of the star), whereby certain colours predominate, and determine the colour of the star.

The remarkable phenomenon of the periodic change of brightness which distinguishes many stars was discussed, and the rare phenomenon of the so-called "new stars" was illustrated by the splendid star which burst forth on May 12, 1866. By the kindness of the discoverer, Mr. Birmingham, of Tuam, the star was examined by the spectroscope before it fell below the 3rd mag.



Spectrum of Absorption and Spectrum of Bright Lines forming the Compound Spectrum of a New Star near ϵ Coronæ Borealis.

The continuous spectrum, crowded with groups of dark lines, shows that there exists a photosphere of incandescent matter surrounded with cooler vapours. The bright lines, two of which were found to be coincident with lines of hydrogen, indicate in addition an envelope of that gas in a luminous state. Now, the observations of the solar eclipse of 1868 show that the prominences which surround the sun give a similar spectrum of bright lines; and as these objects are always present about the sun, their bright lines are always present in the solar spectrum, but they are usually overpowered by the intense light of the photosphere. They, therefore, only render less black the Fraunhofer lines C and F. When, however, the intense brightness no longer exists behind them, as in the case of the umbra of a spot, the bright lines of the luminous hydrogen about the sun exhibit themselves.

In this temporary star, which fell from the 2nd mag. to the 8th mag. in ten days, we may conclude that the surrounding atmosphere of hydrogen had become of extreme intensity as compared with the photosphere. In the star γ Cassiopeia, and two or three very small stars, it has been found since that a similar state of things appears not to be of a very temporary character. News has just come from Melbourne, that by means of the great reflector recently erected there—an instrument by the successful construction of which the distinguished engineer and optician of Dublin, Mr. Grubb, has conferred honour on his city and his country—the remarkable star η Argus has been found to present a similar spectrum.

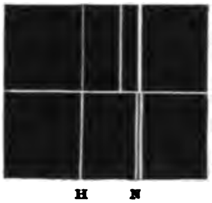
When a telescope of but moderate power is directed to the heavens, a large number of patches of nebulous light are brought to view.

These strange objects had excited, for many years, the curiosity and speculation of astronomers.

The lecturer, in 1864, discovered the remarkable spectrum which is given by the light of the irresolvable nebulæ.

The spectrum consists of three bright lines. Two of these were found to be coincident, respectively, with a line of hydrogen and a line of nitrogen. This observation showed that this nebula was not a group of stars, too remote to be separately visible, but a mass of luminous hydrogen and nitrogen.

NEBULÆ.



His subsequent researches seem to make it certain that these gases really form the greater part of the nebulæ of the irresolvable class. He also found that when the induction spark, passing in these gases, was placed at a distance from the slit, or otherwise diminished in intensity, all the lines peculiar to these gases were extinguished, with the exception of the one line in each spectrum which is found in the nebulæ.

All the clusters, which are resolved by the telescope into distinct bright points, give a continuous spectrum. From a comparison of the spectroscopic examination of about 60 nebulæ with the telescopic observations made by the late Lord Rosse of the same objects, it would seem that, broadly speaking, the resolvable nebulæ give a continuous spectrum, and the nebulæ which the telescope fails to resolve into stars a spectrum of bright lines, which shows their gaseous nature.

The lecturer, from a comparison of the light of some of the nebulæ with a terrestrial standard, found the brightness of some of these objects to be from the 1-6000th to 1-20000th part of that of a sperm candle consuming 158 grains of material per hour.

Of the nature of the phenomena presented by comets, those strange masses of light of constantly changing form, we possess but little certain information. It is doubtless to spectrum analysis that we must look for any important increase of our positive knowledge of the constitution of these bodies, and of the true nature of the remarkable changes which take place in them under the action of the solar rays.

A not unimportant earnest of the more complete information which the prism will doubtless exact from the next brilliant comet has been already gained by the examination of five faint comets. These observations showed that the greater part of the light from the heads of comets is very different from solar light, and cannot be the sun's light sent to us by ordinary reflection from cometary matter.

The spectrum of Winnecke's comet (comet 11, 1868), and also that of Brorsen's comet, at its return in 1868, consisted of three bright bands in similar but not identical parts of the spectrum. The circumstance that the bands were narrower in the spectrum of Brorsen's comet than in that of the other comet might be due to the smaller intensity of the light of that comet, in consequence of which the bands could not be traced so far in the instrument. If this possible explanation of the difference in breadth of the bands be admitted, there will remain the difference of refrangibility in the strongly marked beginning of the middle bands of the two comets.

The spectrum of Winnecke's comet was found to be identical with the spectrum of carbon, as it is presented when the induction spark is taken in olefiant gas. The apparently well-founded conclusion would be, that the cometary matter from which the light comes consists of the luminous vapour of carbon.

It must not be overlooked that, on this supposition, a formidable difficulty presents itself in the insufficiency of the degree of solar heat to which this comet was subjected for the conversion of carbon into vapour. We cannot, for several reasons, suppose that the solar heat was supplemented by the heat of chemical action which it called forth. The suggestion, however, that carbon may possibly exist in an allotropic state, in which it may be much less fixed, and so capable of passing into vapour at a comparatively low temperature, is not perhaps inconsistent with our positive knowledge of other elements. Even if this suggestion were true to fact, a difficulty would remain; for, so far as we know, vapour in the non-luminous state, though it would not transmit light of the refrangibilities which it would emit when heated, would not give them back by reflection, so as to reflect light similar to that which is peculiar to it in the luminous condition.*

The lecturer discussed the phenomena which usually characterize a comet's approach to the sun, and showed that the recent ingenious speculations of Tyndall on the nature of comets appear to be inconsistent with the known phenomena of these mysterious bodies. For further positive knowledge of the nature of cometary phenomena we must, doubtless, wait until the searching method of analysis by the prism can be applied to the series of changes presented by a brilliant comet.

The lecturer then gave an explanation of the method he employed to determine the velocity of approach or of recession of a star. The importance of this research becomes obvious when it is remembered that by ordinary methods of observation that part only of a star's motion which is transverse to the line of sight can be detected; for any movement of the star directly towards or from the earth would not cause any apparent change in its place. Just as to a swimmer striking out from the shore the waves appear shorter, and to succeed each other more quickly than to an observer standing on the beach, so a larger number of waves of ether enters the eye in a given time when the source of the light and the observer are approaching each other. The lecturer illustrated the change of refrangibility, or position in the spectrum, of light produced by the motion of approach or recession, by experiments with sounding bodies.

---

* It might be possible that a spectrum of bright bands would be given by a gas in a fluorescent state; but the circumstance of the coincidence of the cometary spectrum with that of carbon would remain unexplained.

yer, and the lecturer that the red flames seen about the su total eclipse might be seen by aid of the spectroscope w eclipse, though Mr. Lockyer was the first to publish the sugg such a method of viewing the flames was possible. It was especially from theoretical considerations suggested by Mr. St the red flames would give a spectrum of bright lines.

The invisibility of these objects on ordinary occasions is much to the glare of the sun as to the large amount of light by our atmosphere, and which is more intense than the red yond it. Now, if these objects give a few bright lines only, troscope would reduce very greatly the brightness of the at and leave the bright lines of the flames almost undiminished sity, so that they would then become visible. These att various reasons, were not then successful.

This was the state of things, when in August, 1868, the ol the total eclipse discovered that the red flames give a spectrum lines. The day following the eclipse, Janssen, one of the I servers, applied the spectroscope successfully, and showed th principal lines are those of hydrogen, and a third line ne sodium but not coincident with it. About a month later, Mr having received a more powerful telescope, observed the li prominences.

Mr. Lockyer has since examined the lines with much su finds that under certain circumstances other lines, as some iron, barium, magnesium, and sodium, are seen associated wit of hydrogen. From the amount of thickening out of the b line of hydrogen in the green (F), the approximate density o matter may be obtained. The occasional observed want of exact coincidence of the bright lines with the corresponding dark lines in the solar spectrum seems to show that at these times the solar matter is in motion in the line of sight, a state of things suggesting cyclonic movements in the luminous gas. Up to this time the lines only of the red flames had been seen; their forms were inferred by making the slit travel over the prominences. The lecturer, by usin slit, with certain precautions, furnished a method by which jects could be seen directly. The first prominence seen by th is represented in the diagram.

There were then shown upon the screen the strange forms these flames, to exhibit the rapid changes which sometimes in them during the interval of a few minutes.

The exact nature of the other phenomenon seen at a time eclipse, the corona, is still somewhat doubtful. The Indian represent the corona to give a continuous spectrum, and to be showing it to consist of reflected solar light. The American observers of last year believe that they have detected in its spectrum bright lines, and they state that the coronal light near the limb is not polarized. The true nature of this light about the sun will be the most important object of investigation at the next solar eclipse, in December of this year, which will be visible in the south of Spain, in Sicily, and in some parts of the north coast of Africa.

LII. — *The Æsthetical Relations of the Curves of the Human Spine.* By Alexander Macalister, Professor of Artistic Anatomy, Royal Dublin Society.

[Read February 17, 1870.]

In a Lecture published in the Journal of this Society in 1869, I made a few remarks on the debated question, whether beauty in form is a fixed invariable quality of certain outlines and proportions, or an indefinable idea, depending on fancy, and associated with form by imagination alone; and I gave reasons for the former belief, that we have in Nature a fixed basis for the science of beauty, as firm and stable as that of any other branch of Natural science. However, as it is scarcely possible for any thoughtful man of unprejudiced mind to be satisfied with the theories of Alison and Burke, which disregard the idea of fixity of basis for beauty, I will assume it as admitted that such a fixed basis exists; and the object of this paper is to indicate some of the forms of which beauty can be predicated as an attribute, and the probable special reasons why we experience pleasurable sensations from viewing them.

A due attention has never been given to æsthetical studies from a scientific point of view. Hundreds of men, either in a professional or amateur capacity, devote time to music, painting, or sculpture, but few have thought of reducing to a scientific formula the causes of our pleasure in the contemplation of the beautiful; and yet it is manifest that these fine arts are attractive because of the pleasure which they give to the senses, and also that to please the senses certain conditions must be fulfilled; therefore, if we could learn these conditions scientifically, we would be in a position to extend the capacity of the production of pleasurable emotions. In some of the branches of æsthetical science this is to some extent provided for by empirical laws and rules; and these, as far as they go, are of great value—indeed, we have not as yet acquired a sufficient knowledge of the nature of æsthetical sensations to go beyond the domain of empiricism; but the full maturity of this science will never be reached until we can inductively trace these rules to their sources, and thus lay down broad principles upon which to build a perfected science of Æsthetics.

The bounds of this science of Æsthetics include the pleasurable feelings produced by the affections of the various senses, and the methods by which external objects so affect these as to give to us sensations of gratification: thus we have special departments dealing with sight, smell, touch, and taste. Much has been done of late in the way of showing analogies between the phenomena of sound and sight; and we have, from these, and from the consideration of the physiological construction of the special sense organs whereby we appreciate these impressions, good reasons to assume that in each department of æsthetical science the same or analogous conditions produce in us sensations of satisfaction or dissatisfaction.

The credit of attempting, in accordance with the theory of the correlation of sensations, to formulate the physical conditions upon which beauty in form depends belongs to the late Mr. D. R. Hay, of Edinburgh, who in his numerous works on this subject makes many valuable and suggestive statements on the subject, the principal of which we may summarize into the following propositions:—

1. An analogy exists between harmony in music and beauty in form.
2. A special scale of forms may be tabulated, in which the curve, square, and triangle are analogous to the tonic, mediant, and dominant of the musical scale.
3. The greatest amount of beauty is to be found in those forms possessing variety in harmony.
4. Combinations of outlines, to give the sensation of beauty, must be of such forms as possess to each other similar numerical ratios to those of the notes which are musically harmonious.

If this theory be true, that such harmonies of form exist, we should find in the human body a perfect illustration and confirmation of it, as by universal consent a perfectly formed human body—an Apollo or Antinous—is the most beautiful combination of outlines with which we are acquainted. The best and clearest evidences of the ratios obtaining between these combinations must be found in those parts of the body which display to us varieties of curves in combination, such as the outline of the spinal column, the clavicle, &c.

In order to obtain materials for an examination of the truth of this supposition it was necessary to obtain several outlines of the curvatures of the different regions of the spine; and to procure these I asked a number of the best formed and most erect of the students of the Medical School of the Royal College of Surgeons to draw for me an outline of their spinal curvatures, and gave them explicit directions as to the method by which they could most effectually do this, each student getting his outline carefully drawn by his chum. I thus obtained about eighteen such delineations; and of each of these I determined 1st, the angle subtended by each of the several component curves; 2nd, the radial length of the circles of which these curves were arcs. As the young men were all about the same height, I was surprised to find a striking uniformity in their curvatures, so that the average of the entire series differs but little from the formulation of each individual. I take this opportunity of thanking these gentlemen for the trouble and pains taken by them to procure for me these delineations.

In my earliest attempts at ascertaining the numerical ratios of these curvatures I supposed that the several regional curves were simple single arcs; but careful measurement speedily showed me that this is not strictly true; for each curve is compound, and, as will be seen hereafter, the components of each regional curve have a special harmonious relation the one to the other.

The numerical ratios to which we shall compare these measures are based upon the relations of the different notes in the musical scale. It is well known by all conversant with the principles of music, that to produce the seven notes of the scale we require to divide the string which by vibrating produces the tonic into certain proportional lengths. Dividing the 360° of a circle in these proportions, we get a series of angles which by hypothesis have to each other the ratios of the notes in the musical scale.

C 1	D $\frac{8}{9}$	E $\frac{4}{5}$	F $\frac{3}{4}$	G $\frac{2}{3}$	A $\frac{3}{5}$	B $\frac{8}{15}$	C′ $\frac{1}{2}$
°	°	°	°	°	°	°	°
360	320	288	270	240	216	192	180
180	160	144	135	120	108	96	90
90	80	72	67·5	60	54	48	45
45	40	36	33·75	30	27	24	22·5
22 5	20	18	16·875	15	13·5	12	11·25
11·25	10	9	8·4375	7·50	6·75	6	5·625
5·625	5	4·5	4·21375	3·75	3·375	3	2·8125

The following Table gives the relations which obtain between the angular dimensions of the curves of the male spine and the radial lengths of the various spinal curvatures :

					°		
Superior	Cervical,	from	Occip. Protuberance to	4th Cervical,	45	Radius,	3 in.
Inferior	„	„	4th Cervical to	7th „	36	„	4½ in.
Superior	Dorsal,	„	1st Dorsal to	5th Dorsal,	30	„	18 in.
Inferior	„	„	6th „ to	3rd Lumbar,	18	„	36 in.
„	Lumbar,	„	3rd Lumbar to	5th „	60	„	2¼ in.
Superior	Sacral,	„	5th „ to	3rd Sacral,	22·5	„	12 in.
Inferior	„	„	3rd Sacral to	4th Coccygeal,	72	„	4½ in.

The two component cervical curves, 45° and 36° thus correspond in ratio to C and E; those of the dorsal region, 30° and 18° to G and E; those of the lumbar and sacral, 60°, 22·5° and 70° to G, C^1 and E. It thus appears at a glance that these ratios are precisely those of the most harmonious notes in the scale of C major, and are, from above downwards, C, E, G, E, G, C^1, E.

The radii are similarly harmonical in length; for if we take 36·18·9·4½ as the Tonics, C^1, C^2, C^3; then 3 in the first cervical radius corresponds to G^3; the second, 4½ to C^3; the first dorsal, 18, to C^1; the second, to C; the lumbar, to C^4; the upper sacral, to G^1, and the last to C^3.

In works on anatomy, the natures of these curves are not sufficiently distinguished in general. There are in the spine two series of flexures functionally separate from each other: the first and most important are curves of accommodation, as the dorsal and sacral; the second are curves of compensation, as the cervical and lumbar, intercalated to keep the axis of the column vertical; and so well are these proportioned in the human subject, that the perpendicular dropped from the middle of the odontoid process of the axis cuts the bodies of the vertebræ below in five points, as noticed by Goodsir. This is not the case in any other mammal; for, as Professor Goodsir has shown, in the anthropoid apes this perpendicular cuts the vertebral bodies only in four points at the utmost, and in few animals more than in three places ("Anatomical Memoirs," vol. i., p. 225).

The measurements given above refer only to the male spinal column. Those of the female have the following ratios:—

	°		
Superior Cervical,	45,	Radius,	2¼ in.
Inferior „	80,	„	3¼ in.
Superior Dorsal,	37·75,	„	8 in.
Inferior „	22·5,	„	13 in.
„ Lumbar,	80,	„	5¼ in.
Superior Sacral,	18·875,	„	16 in.
Inferior „	45,	„	5¼ in.

These numbers illustrate to us an important and deeply interesting point: taking the harmonical ratios of their angles, as before, we find they correspond to C, G, E flat, C^1, G, E flat^1 C; but these notes are the tonic, mediant and dominant of the minor key of C, so that the male spinal curvatures are to the female as the major scale of C is to the minor. Nay more, the most characteristic portions of the female spine anatomically are the upper dorsal and the sacral portions; and, by a strange coincidence, these are the parts where the curves correspond to E flat.

LIII.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

THE COMPILER.

Adelaide Almanack . . . . Directory, and Guide to South Australia, for 1870 . . . . By Josiah *Boothby*, Esq., Government Statist. 8vo. *Adelaide*, 1870

THE AUTHOR.

Andrews (J. A., Barrister-at-Law). Life of Oliver Cromwell to the death of Charles the First. 8vo. *London*, 1870

L'ACADÉMIE ROYALE DES SCIENCES, DES LETTRES, ET DES BEAUX-ARTS DE BELGIQUE.

Annuaire de l'Académie Royale des Sciences, des Lettres, et des Beaux Arts de Belgique. 12mo.
1868. Trente-Quatrième Année. *Bruxelles*, 1868
1869. Trente-Cinquième Année. *Bruxelles*, 1869

THE AUTHOR.

Archer (William Henry, Registrar-General of Victoria). Patents and Patentees, from 1854 to 1866 (both inclusive). 4to. *Melbourne*, 1868

Archer (William Henry, Registrar-General of Victoria), Abstracts of English and Colonial Patent Specifications relating to the Preservation of Food, etc. 8vo. *Melbourne*, 1870

THE LIBRARIAN OF TRINITY COLLEGE, DUBLIN.

Athenæum (the) . . . . for the Year 1851 4to. *London*, 1851

THE AUTHOR.

Ball (Professor Robert Stawell, A. M.). A Problem in Mechanics. [Extracted from *The Quarterly Journal of Pure and Applied Mechanics*, No. 39, 1869.] 8vo. *s. l.*, *s. a.*

THE ORATOR.

Barry (Sir Redmond). Address on the opening of the Free Public Library of Ballarat, on Friday East, 1st January, 1869. 12mo. *Ballarat*, 1869

LORD TALBOT DE MALAHIDE.

Belfast and its Environs, with a Tour to the Giant's Causeway. 8vo. *Dublin*, 1842

THE AUTHOR.

Cameron (Charles A., Ph. D., M. D., ... Analyst to the City of Dublin, etc.). Lectures on the Preservation of Health . . . . 8vo. [Dublin Printed]. *London* and *New York*, 1869.

THE SCIENCE AND ART DEPARTMENT OF THE COMMITTEE OF COUNCIL ON EDUCATION.

Catalogue (with an Appendix) of the Naval Models in the South Kensington Museum.— . . . 8vo. *London*, 1869

SIR REDMOND BARRY, Melbourne.

Catalogue of the Works of Art . . . . exhibited by the . . . . Melbourne Public Library and Museum in . . . . 1869. Final Edition.
Melbourne, 1869

THE COMMITTEE OF THE METEOROLOGICAL OFFICE, WESTMINSTER.

Charts showing the Surface Temperature of the South Atlantic Ocean in each month of the year. . . . Folio. *London,* 1869

THE GENERAL LAND OFFICE, DEPARTMENT OF THE INTERIOR, WASHINGTON.

Circular from the General Land Office, showing the manner. . . . to obtain . . . . Public Lands. . . . 8vo. *Washington,* 1869

LORD TALBOT DE MALAHIDE.

Crowland Abbey, the . . . . History of . . . . with observations on . . . . the Triangular Bridge. 16mo. *Crowland,* 1857

Denton (Rev. W., M. A., ...). The Christians in Turkey.
8vo. *London,* 1863

THE REV. BEAVER H. BLACKER, A. M., Rural Dean, Booterstown.

Dublin Christian Instructor . . . . for the year 1818, 1819.
Vol. I. 8vo. *Dublin* [1818, 1819]

LORD TALBOT DE MALAHIDE.

Foulkes (Edmund S., B. D., ...). The Church's Creed or the Crown's Creed?——A Letter to . . . . Archbishop Manning, etc. etc. Sixth Thousand. 8vo. *London, s. a.* [1868]

THE REV. BEAVER H. BLACKER, A. M., Booterstown, Rural Dean.

Freeman (Edward A., M. A., ... Oxford). The Preservation and Restoration of Ancient Monuments . . . . read before the Archæological Institute at Bristol, July 29, 1851.
8vo. *Oxford* and *London,* 1852

J. CATHCART, ESQ., Collector, Inland Revenue, Custom House.

Game Licenses. Year 1869–70. Names and Addresses.
Folio. *London,* 1869

THE AUTHOR.

Gore (G., F. R. S.). On Hydrofluoric Acid. 4to.
[Read January 28, 1869].

THE AUTHOR.

Grimshaw (Thomas Wrigley, A. B., M. D. (Dub.): . . . .). Thermometric Observations on Pneumonia. [Reprinted from "The Dublin Quarterly Journal of Medical Science," May, 1869.]
8vo. *Dublin,* 1869

THE AUTHOR.

Haughton (E., A. B., M. D., M. R. C. S. E. . . . .). The Laws of Vital Force, in Health and Disease, or The True Basis of Medical Science. Second Edition . . . . 8vo. *London,* 1869

THOMAS BEANY, Chief Library Porter, Royal Dublin Society.

Holtzendorff (Baron Franz von, ... Berlin). The Irish Convict System, more especially Intermediate Prisons. Translated from the German. 8vo. *Dublin*, 1860

LORD TALBOT DE MALAHIDE.

Hungarian Diet of 1861. The Addresses of, to . . . . the Emperor of Austria, with the Imperial Rescript and other Documents. Translated . . . . by J. Horne *Payne*, Esq., M. A. Lond., of the Inner Temple. 8vo. *London*, 1862

THE RIGHT HON. THE SECRETARY OF STATE FOR WAR.

James (Colonel Sir Henry, R. E., Director of the Ordnance Survey). Facsimiles of National Manuscripts from William the Conqueror to Queen Anne . . . . Part IV., with Translations and Notes. Folio. *Southampton*, 1868

THE AUTHOR.

Leared (Arthur, M. D., M. R. I. A.). On the Presence of Sulphocyanides in the Blood and Urine. [From the Proceedings of the Royal Society, No. 114, 1869.] 8vo.

THE TRANSLATOR.

Mac Carthy (Denis Florence, M. R. I. A.). The Two Lovers of Heaven : . . . a Drama of Early Christian Rome. From the Spanish of *Calderon* . . . . etc. 8vo. *Dublin* and *London*, 1870

THE AUTHOR.

Mac Carthy (John George). The History of Cork. A Lecture. Second Edition . . . . 8vo. *Cork*, 1869

THE REV. BEAVER H. BLACKER, Booterstown, Rural Dean, Rokeby, South-hill Avenue, Blackrock.

Macdonald (Rev. Thos. M., M. A., ... Nottingham). The Church Catechism and Confirmation; a Manual of Questions . . . . 8vo. *London*, *s. a.*

THE AUTHOR.

M'Donnell (Robert, Esq., M. D., F. R. S.). Patronage and Purchase in making Appointments. A Paper read before the Statistical . . . . Society of Ireland, November, 1869. 8vo. *Dublin*, 1870.

THE AUTHOR.

Mapother (E. D., M. D., etc.). The Dublin Hospitals: their Grants and Governing Bodies . . . . Read before the Statistical and Social Inquiry Society of Ireland, on 22nd June, 1869 . . . . With the Discussions thereon. 8vo. *Dublin*, 1869

THE AUTHOR.

Mapother (E. D., M. D. . . . .). The Body and its Health: a book for Primary Schools. Third Edition. 16mo. 128 pages. *Dublin*, *s. a.*

THE AUTHOR.

Mapother (E. D., M. D., ...). Teachers' Aid and Questions on "The Body and its Health." 16mo. 71 Pages. *Dublin, s. a.*

[*These two bound up together.*]

THE PUBLISHER, JOHN VAN VOORST, 1, Paternoster-row, London, E. C.

Martin (John, Secretary to the Maidstone and Mid-Kent Natural History Society). Microscopic Objects Figured and Described. 8vo. No. 1. January, 1870. *London,* 1870

THE PROPRIETOR.

Maw (S.), *Son & Thompson,* Book of Illustrations to Quarterly Price-current [of Surgical Instruments, &c.]. 4to. *London,* 1870

LORD TALBOT DE MALAHIDE.

Memorandum of the . . . . Administration of India during the last Thirty years, ... Petition of the East India Company to Parliament. 8vo. *London,* 1858

THE AUTHOR.

Meyler (Walter Thomas, M. R. D. S.). Ballads, Odes, Stanzas, Lyrics, on the Great American War, 1861–1865 . . . . 8vo. *Dublin,* 1868

Meyler (Walter Thomas, Member of the Royal Dublin Society). Saint Catherine's Bells: an Autobiography.
Volume I. Second Edition. *London* and *Dublin,* 1868
Volume II. 8vo. *London* and *Dublin,* 1870

HOMMAGE DE L'AUTEUR.

Mouvement Politique en France, depuis 1789 jusqu'à nos jours. 8vo. *Toulon,* 1869

OSSEQUIO DELL' AUTORE.

Negri (Comm. Cristofero, Presidente della Societa Geografica Italiana . . . .), Discorso del . . . . 13 Marzo 1870. 8vo. *Firenze,* 1870

THE PROVOST AND SENIOR FELLOWS OF TRINITY COLLEGE, DUBLIN.

Observations made at the Magnetical and Meteorological Observatory of Trinity College, Dublin: under the Direction of Humphrey *Lloyd,* D. D., D. C. L., Provost of Trinity College, Dublin . . . . Vol. II.—1844-1850. 4to. *Dublin,* 1869.

E. PERCEVAL WRIGHT, M. D., etc.

Pourtales (L. F. de, Assist. U. S. Coast Survey). Contributions to the Fauna of the Gulf Stream at Great Depths.

THE NOVA-SCOTIAN INSTITUTE OF NATURAL SCIENCE (W. GOSSIP, ESQ., Secretary.)

Proceedings of the Nova Scotia Institute of Natural Science. Vol. II. Part II. 8vo. *Halifax, Nova Scotia,* 1869

THE ZOOLOGICAL SOCIETY OF LONDON.

Proceedings of the Scientific Meetings of the Zoological Society of London for the Year 1869. 8vo. *London, s. a.*

MESSRS. HODGES, FOSTER, AND CO.

Proposed Amended Draft of an Act of Constitution, to be submitted to The General Convention of the Church of Ireland. [pp. 39.] 8vo. *Belfast*, 1870

LORD TALBOT DE MALAHIDE.

Question of Languages in the Duchy of Schleswig. A Memorandum translated from the German. 8vo. *London*, 1861

THE AUTHOR, by M. Gauthier-Villars, Rue de Seine, Saint-Germain, Paris.

Realis (M. S., Ingenieur à Turin). Notes sur le Nombre *e*. 8vo. [*Paris*, 1869]

THE WISCONSIN STATE AGRICULTURAL SOCIETY.

Reid (David Boswell, M. D., F. R. S. E., ...), ... Address delivered before the Wisconsin State Agricultural Society . . . . September 27th, 1860. 8vo. *Madison*, Wis., 1861

THE REV. BEAVER H. BLACKER, M. A., Booterstown, Rural Dean.

Reeves (William, D. D.). Analysis of the United Dioceses of Dublin and Glendalough. 8vo. *Dublin*, 1869

Report (Sixty-third) of the Hibernian Bible Society . . . . . . MDCCCLXIX . . . 8vo. [*Dublin*, 1869]

Report (Fifty-first) of the Irish Society . . . . for the Year ending March 25, 1869. . . . 8vo. *Dublin*, 1869

THE METEOROLOGICAL OFFICE, 2 Parliament-street, Westminster, S. W.

Report . . . . On the Meteorology of the North Atlantic, ... with Remarks . . . . by Captain Henry *Toynbee*, F. R. A. S. . . . . 8vo. *London*, 1869

THE PLYMOUTH INSTITUTION AND DEVON AND CORNWALL NATURAL HISTORY SOCIETY.

Report (Annual) and Transactions of the Plymouth Institution and Devon and Cornwall Natural History Society. Volume III. Part II. 1868-9. 8vo. *Plymouth*, 1869

THE ROYAL CORNWALL POLYTECHNIC SOCIETY, BY A. S. Fox and W. P. DYMOND, F. M. S., Honorary Secretaries.

Report (the Thirty-seventh Annual) of the Royal Cornwall Polytechnic Society, 1869. 8vo. *Falmouth*, *Truro* [1869]

THE SCIENCE AND ART DEPARTMENT OF THE COMMITTEE OF COUNCIL ON EDUCATION.

Report of the Commission for Heating, Lighting, and Ventilation of the South Kensington Museum. 8vo. *London*, 1869

E. PERCEVAL WRIGHT, M. D., &c.

Report (Annual) of the . . . . Museum of Comparative Zoology at Harvard College, in Cambridge . . . . 1868. 8vo. *Boston*, 1869

THE AUTHOR.

Research. The True Theory of the Earth, and Philosophy of the Predicted End . . . . 8vo. *Edinburgh*, 1869.

LORD TALBOT DE MALAHIDE.

Ribton (Henry, Trinity College, Dublin). Poems. 32mo. *Dublin*, 1846

THE AUTHOR.

Ringland (John, A. B.; M. B.; M. D., Univ. Dub. . . . .). Annals of Midwifery in Ireland.—An Address, ... at a Meeting of the Dublin Obstetrical Society, on 20th November, 1869, by the President. 8vo. *Dublin*, 1870

REV. BEAVER H. BLACKER, A. M., Booterstown, Rural Dean.

St. Patrick's Church, Jordanstown . . . Carnmoney, ..., A Notice of . . . . with Memoirs of the Irish Saints . . . . in the Windows. [Printed for private circulation only]. 8vo. *London*, 1868

Spence (William, Assoc. Inst. C. E., Patent Agent). The Public Policy of a Patent Law, ... 8vo. *London*, 1869

THE GOVERNMENT OF SOUTH ADELAIDE, by JOSIAH BOOTHBY, ESQ., UNDER SECRETARY FOR THE COLONY.

Statistical Register of South Australia for 1868 . . . . Folio, *Adelaide*, 1869

JAMES HAUGHTON, ESQ., J. P.

Stokes (William, Manchester, . . .). British War History during the present Century . . . . 8vo. *London*, 1869

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

Transactions of the Highland and Agricultural Society of Scotland. No. 5. Fourth Series [Vol. III., part 1]. 8vo. *Edinburgh* [1870]

THE LONDON AND MIDDLESEX ARCHÆOLOGICAL SOCIETY.

Transactions of the London and Middlesex Archæological Society. Vol. III.—Part X. 8vo. *London*, 1870

THE NATIONAL ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.

Transactions of the National Association for the Promotion of Social Science.—British Meeting, 1869.—Edited by Edwin *Pears*, LL. B., General Secretary . . . . 8vo. *London*, 1870

THE PATHOLOGICAL SOCIETY OF LONDON.

Transactions of the Pathological Society of London. Volume Twentieth.—. . . Session 1868-69. 8vo. *London*, 1869

THE WISCONSIN STATE AGRICULTURAL SOCIETY.

Transactions of the Wisconsin State Agricultural Society. . . . . and kindred Institutions . . . . 8vo.

Vol. VI.—1860. Edited by J. W. *Hoyt*, Secretary, *Madison*, 1861

Vol. VII.—1861-2-3-4-5-6-7-8 . . . .. *Madison*, 1868

[See *Reid* (David Boswell, M. D., F. R. S. E.,) . .]

The Lords of the Committee of Council on Education.

Universal Catalogue of Books of Art (the First Proofs of). . .
Vol. I.—A to K.
Vol. II.—L to Z. 4to. *London,* 1870

The Hon. George Frederick Verdon, C. B., Agent-General for Victoria.

Victoria.—The Land Act, 1869; with the Rules . . . . Forms . . . . List of Land Officers . . . . Compiled under the direction of the Hon. James *M'Kean,* . . . . Commissioner of Crown Lands . . . . 8vo. *Melbourne,* 1870

The Rev. Beaver H. Blacker, A. M., Rural Dean, Booterstown.

Villanueva (Dr. D. Joaquin Lorenzo, ...). Poesias Escogidas . . . 12mo. *Dublin,* 1833

Dr. James M. Barry, M. R. D. S.

Vocabulary of Dialects spoken by Aboriginal Natives of *Australia* (Six Broadsides, *s. l.*, *s. a.*)

The Author.

Wright (E. Perceval, M. D., F. L. S., F. R. S. S. I., &c., Professor of Botany, Dublin University). Spicilegia Biologica; or Papers on Zoological and Botanical Subjects.
Part I.—January, 1870.
(*Only* 75 *Copies Printed.*) 8vo. *s. l.*, *s. a.*

Wright (Edward Perceval, M. D., F. L. S., Professor of Botany, Trinity College, Dublin). Contributions towards a Knowledge of the Flora of the Seychelles . . . .
From the Transactions of the Royal Irish Academy, Vol. XXIV.—Science Read December 14th, 1868. 4to. *Dublin,* 1869

(Signed) Edw. Richards Purefoy Colles,
June 2, 1870. *Librarian.*

BOTANIC GARDEN.

Horace Capman, Esq., Commissioner, Department of Agriculture, *Washington, U. S., America:*—A very valuable donation of 95 packages of Seeds of different species of American Plants, sent officially by the American Government agents (*freight paid*).

Mr. A. Reith, 9, *Cambridge-terrace, Loddiges-road, Hackney, near London:*—Seeds of 22 species of Plants from the Azores.

H. Yates Thompson, Esq., Private Secretary to His Excellency the Lord Lieutenant:—A large bagful of Seeds of *Cedrus deodora* from India; also supplies of two kinds of Pine Seeds from Himalayas.

Thomas Glover, Esq., *Lonsdale House, Lytham, Lancashire:*—Package of Seeds of *Picea nobilis.*

W. ANDREWS, Esq., M. R. D. S.:—13 species of Seeds from India.

MISS COLLES, 45, *Park-avenue, Sandymount* :—4 kinds of Indian Seeds.

MESSRS. VEITCH, *Nurserymen, Royal Exotic Nursery, Chelsea*:—43 very rare and valuable Plants.

MR. BULL, *Nurseryman, King's-road, Chelsea* :—21 rare and new Plants.

MR. J. SOWERBY, *Botanic Garden, Regent's-park, London* :—9 rare Plants.

DR. HOOKER, C. B., *Royal Gardens, Kew* :—47 rare and valuable Plants.

MR. HENDERSON, 42, *Fitzwilliam-place* :—12 kinds of Fern Spores.

DR. HOOKER, *Royal Gardens, Kew* :—Seeds of Nepenthes from Ceylon.

MRS. HIGGINS, *Springmount, Glarryford, Belfast* :—12 kinds of Seeds of rare Plants from the Mauritius.

T. TILSON MAGAN, Esq., 5, *Herbert-street* : — 3 packages of Indian Seeds.

The REV. H. ELLICOMBE, *Bitton Rectory, near Bristol* :—50 species of rare hardy Herbaceous Plants.

HERR LEICHTLIN, *Carlsruhe, Duchy of Baden* :—6 bulbs of Liliums.

The REV. AUSTIN COOPER, *Auburn Lodge, Upper Rathmines* :—Curious specimen of old gnarled stem of Tree. For Botanical Museum.

HERR BOUCHÉ, *Inspector of Botanic Garden, Berlin* :—Case full of rare Agaves and other valuable Plants.

CHARLES W. HAMILTON, Esq., *Hamwood, Clonee* :—A collection of Plants and Cuttings of new and rare Pelargoniums.

DR. HOLMES, 163, *Dorset-street* :—6 kinds of Seeds from Japan.

J. NIVEN, Esq., *Botanic Garden, Hull* :—22 rare Alpine Plants.

HERR MAX LEICHTLIN, *Carlsruhe* :—2 bulbs of Liliums.

CAPT. FREDERICK HENDERSON, A. D. C., *Doveton House, Madras, E. I.* :— 12 kinds of Fern Spores.

HERR M. WENDLAND, *Director, Botanischer Garten, Herrenhausen, Hanover* :—Case filled with rare Palms, Pandannads, &c.

CHARLES MOORE, Esq., *Director, Botanic Garden, Sydney, New South Wales*:—164 parcels of Seeds, a portion of which was collected on Lord Howe's Island.

DR. HOOKER, *Royal Gardens, Kew* :—3 rare Plants.

The VERY REV. MR. VERDEN, *Principal, Clonliffe College, Jones's-road*:— A magnificent specimen of the half-hardy Palm (*Chamærops humilis*), 14 feet high, probably the best in Britain?

CAPT. HENDERSON, A. D. C., *Doveton House, Madras, E. I.* :—12 kinds of Fern Spores.

GILBERT BURNS, Esq., *Knockmaroon, Castleknock* :—A fine and valuable Tree Fern (*Cibotium princeps*), with fronds 8 feet long.

PROFESSOR REICHENBACH, *Botanischer Garten, Hamburgh*:—A small case full of living plants of *Salvinia natans*—very rare.

CAPTAIN HENDERSON, A. D. C., *Doveton House, Madras*:—12 species of spores of Ferns.

THOMAS HONE, Esq., M. R. D. S., *Yapton House, Monkstown*:—Package of East India Seeds.

MR. WHEELER, *Nurseryman, Winchester*:—38 rare Plants.

MAX LEICHTLIN, *Carlsruhe*:—Fine bulb of the rare and newly introduced *Lilium Washingtonia.*

DR. CARTE, *Director, Natural History Museum*, R. D. S.:—A curious specimen of Stem of Broom, for Botanical Museum.

H. Y. THOMPSON, Esq., *Viceregal Lodge*:—3 papers of Seeds from North India.

M. ORTGIES, *Botanic Garden, Zurich*:—18 packages of Californian Seeds.

DR. REICHENBACH, *Botanic Garden, Hamburgh*:—83 packages of Seeds.

DR. CASPRAY, *Botanic Garden, Konigsberg*:—31 packages of Seeds.

M. LE DIRECTEUR, *Museum d'Histoire Naturelle, Paris*:—220 packages of Seeds, and 8 kinds of Plants.

O'NEILL SEAGRAVE, Esq., *Kiltymore, Newtownmountkennedy, Co. Wicklow*:—2 plants of *Benthamia fragifera.*

M. BOUCHÉ, *Inspector, Botanischer Garten, Berlin*:—64 packages of Seeds.

COLONEL MEADOWS TAYLOR, C. S. I., J. P., *Oldcourt, Harold's-cross*:—Package of Indian Seeds.

CHARLES ENSOR, Esq., 4, *George's-place, Dublin*:—4 packets of Seeds from Japan.

JOHN LLOYD BAGOT, Esq., J. P., Ballymoe, Castlerea (through DR. STEELE):—4 seeds of *Salisburia adiantifolia.*

CHARLES MOORE, Esq., *Director, Botanic Garden, Sydney, N. S. W.*:—A Wardian case filled with valuable Palms, Ferns, and other Plants, from Lord Howe's Island, and elsewhere in New South Wales.

D. B. LENNARD, Esq., 1, *St. Alban's-terrace, Dublin*:—Seeds of Aloe, from Madras.

CHARLES MOORE, Esq., *Director, Botanic Garden, Sydney, N. S. W.*:—145 parcels of rare kinds of Seeds, collected in different parts of Australia.

June 2, 1870. (Signed) D. MOORE, *Director.*

NATURAL HISTORY MUSEUM.

Edward Waller, Esq., *Aughnacloy* :—Twenty-two rare species of British Mollusca, taken off the Shetland Islands.

Dr. R. Battersby, *Glendalough*, near *Killarney* :—A small Collection of Tertiary Fossils from Cannes, France, and a few Land and Fresh-water Shells from North America.

Lord Clermont (through **W. Andrews**, Esq.):—A fine specimen of the American Bittern (*Botaurus lentiginosus*), shot on the 18th of November, 1868, near Castlering, Louth.

Captain Cane, *Dawson-street* :—A fine specimen of a War Club from New Zealand.

A. P. Allen, Esq., 1, *Lower Sherrard-street* :—A Bark Canoe from North America.

A. M'Donnell, Esq., *St. John's*, *Islandbridge* :—Thirteen Birds' Skins from the shores of the Black Sea, including *Pelecanus crispus*, *Vultur monachus*, &c.

Mr. W. S. Rowe, 11, *Lower Ormond-quay* :—A brilliantly-coloured male specimen of the Cook Wrasse (*Labrus mixtus*).

George Walker, Esq., *Exhibition Palace* :—A Parrot (*Psittacus Carolinensis*) which had died in the Aviary of the Exhibition Palace.

Mr. Edward Williams, 3, *Dame-street* :—A Salamander, from Egypt.

H. R. H. The Prince of Wales :—An Egyptian Mummy and Sarcophagus.

C. Frizell, Esq., *Castle Kevin*, *Annamoe*, *Co. Wicklow* :—A Green Sandpiper (*Totanus ochropus*), shot near Castle Kevin.

Mr. B. Flynn, 2, *William-street* :—A Ballan Wrasse (*Labrus maculatus*).

A. L. Adams, Esq., M. D., Surgeon, 22nd Regiment :—The Skulls of seven species of Mammalia from North America, including the Black Bear, Moose Deer, &c.

Edwin Brown, Esq., *Burton-upon-Trent* :—A Collection of Foreign Beetles.

Miss Courtney, 118, *Lower Baggot-street* :—A portion of the antler of the Giant Fossil Deer of Ireland (*Cervus megaceros*).

R. H. Scott, Esq., *Meteorological Office*, *London* :—Specimens of Minerals from Strontian, N. B.

Sir F. Leopold M'Clintock, R. N. :—Two specimens of the so-called "Blue Mountain Duck" (*Pterodroma Caribæa*), from Jamaica.

Lieutenant C. L. H. Deering, *28th Regiment* (through **Rev. B. Adams**, D. D.) :—A Lizard and a small Box of Insects from Gibraltar.

William Andrews, Esq., *Ashton, Monkstown*:—Two Eggs of the White-crested Cockatoo (*Cacatua cristata*) which had been laid in the Gardens of the Royal Zoological Society, in August, 1869.

W. Corbet, Esq., *Castle Connell, Limerick*:— A Silver Pheasant (*Euplocamus nycthemerus*).

Dr. B. F. Bradshaw, *Bansha, Tipperary*:—Some freshly-killed specimens of native Birds.

Commander A. La Touche, R. N., *Monkstown*:—The Tail of an Indian Elephant.

Professor E. P. Wright, M. D., *Trinity College*:—A large Collection of Echinoderms, including the following:—

From the Seychelles, the Mediterranean, and Ireland, collected by Dr. E. P. Wright.
From Greenland; collected by Edward Whymper, Esq.
From England; collected by the Rev. A. M. Norman.

Mrs. Grey, per Dr. Croker:—A specimen from an auriferous Quartz Reef in South Australia.

E. M'Dowell Cosgreave, Esq., 69, *Eccles-street*:—A few specimens of British Insects.

W. Corbet, Esq., *Castle Connell, Limerick*:—A Black Swan (*Cygnus atratus*).

(Signed) A. Carte, M.D., *Director*.

June 30, 1870.

INTELLIGENCE.

DISTRIBUTION OF PRIZES TO THE STUDENTS OF THE SCHOOL OF ART.

The annual ceremony of distributing the Prizes to the Students of the School of Art took place on Friday, 11th February, 1870, in the Lecture Theatre.

His Excellency the Lord Lieutenant, who was accompanied by the Countess Spencer and their suite, presided. A large number of nobility and gentry were present.

George Woods Maunsell, A.M., D. L., Secretary, said it devolved upon him, in the absence of his brother Secretary, Mr. Waldron—who had been unfortunately obliged to leave Ireland for a short time—to open the proceedings for which they were assembled. When he had the honour of addressing His Excellency on the last occasion he was then new to them—almost a stranger. Doubtless, he had been elected President of the Society, but he had since been declared a Prize Winner in more than one of the competitions held under the Society's auspices. They now regarded His Excellency as one of themselves—as one who had given an earnest in the working of the Society, and who could be relied upon in his public and private position to forward its objects and promote its interests. He (Mr. Maunsell) deemed it unnecessary to go into the various matters which proclaimed their success, as he was to be followed by Colonel Adamson, Chairman of the Committee having the management of the School, to whose exertions much of the present success of the School of Art was due. He might be permitted to say that, during the 130 years their Schools had existed they had sustained that reputation for artistic skill and taste which from the earliest ages appears to be an attribute of the Celtic race; and in the recent contest for the Princess of Wales' Scholarships, open to the United Kingdom, a Student of this Society's School had carried off one of the two awards, the other going to South Kensington. Without further remarks, he would introduce Colonel Adamson, who was prepared to submit the Report on the School.

LIEUTENANT-COLONEL ADAMSON then said—Your Excellency,—The efforts of our Committee during the past year have been earnestly devoted to an endeavour to increase Art education amongst the lower classes. We have given increased facilities to the artizans, and we have had the satisfaction of seeing nearly 500 attendants. This has been one of the great objects of the Royal Dublin Society, and through our city and various parts of the country thousands have been receiving instruction. We have used every effort to obtain the formation of a Museum of Ornamental Art. With the kind assistance of the Right Hon. George A. Hamilton, an amount has been put upon the public estimates which will enable a Museum to be built adjoining our School, and which we trust will receive the final approval of the Chancellor of the Exchequer and of Parliament. We believe it will prove of the greatest value to our pupils. We can speak with great pride of the designs executed by our pupils for manufactures. Most of them are of great merit; some of them of surpassing beauty and the highest excellence. The Committee have been most anxious to utilize the talent exhibited in this respect, and with such view have endeavoured to make arrangements with the Superintendent of the Drawing School at Greenwich that a depot may be formed in London for all the Art Schools of the United Kingdom, where the works of our pupils may be brought under the notice of the leading manufacturers. The duties of our Committee are chiefly administrative. We have associated with us several gentlemen eminent for artistic taste and knowledge—amongst them Mr. Kirk, whose works adorn and beautify many of our churches and palaces; Mr. M'Kay, whose knowledge of Art and ability made him Chairman of the Fine Arts of one of the most successful Exhibitions ever held in Ireland; and many others lately added to us, amongst whom I have the pleasure to name Lord Powerscourt, an encourager and liberal patron of the arts. But in all cases of judgment upon art we have the valuable assistance of our Vice-Presidents, who are Honorary Members of our Committee, and are much indebted in this to Sir George Hodson and General Colomb. The conduct of our pupils is admirable. We never have a complaint. Although from every grade of society, and of different religious persuasions, all are living and learning in concord, and with feelings of devoted loyalty to our gracious Queen. The judicious and gentle management of the Head Master, Mr. Lyne, has done much for their advantage. His talents and excellent method of conveying instruction are universally admitted, and he has gained the esteem and respect of those under whom he is acting, and also of the pupils. Although we are aware the thanks of the Royal Dublin Society will be offered to your Excellency, I have been specially desired by our Committee to assure you that the pupils who are to receive those medals and rewards will doubly value them at the hands of your Excellency, and of the gracious lady who has done them the honour of accompanying you this day.

COLONEL ADAMSON then read the following Report:—

REPORT OF THE FINE ARTS COMMITTEE OF THE ROYAL DUBLIN SOCIETY FOR THE YEAR 1869.

IN Reporting upon the School of Art for the year 1869, we have again to direct your attention, as it has been our pleasing duty for several years past, to the position these Schools continue to maintain, when subjected to the severe ordeal of a National Competition; and the very prominent place that they hold on these occasions has been a source of great satisfaction to the Committee of Fine Arts, and to the Society at large.

We beg also to allude to the matured system of instruction, and its able administration, in force in our Schools—a system calculated to bring forth latent power, and to lead to the highest results—but demanding patient and sustained efforts on the part of Students.

We have to speak of a recent arrangement by which Sessional Fees only are received in the Day Classes, and from which some falling off in the number of Students was anticipated; the result, however, has been an increased attendance; and it is evident that the successful teaching of these Schools, during the past few years, has placed them in the position of the first Art Institution in the country.

It may not be out of place here to refer to the opinion, expressed by a great Art authority, as to the Dublin Schools, before the late Royal Commission on Art and Science in Ireland :—"The Dublin School is managed just on the same principles as in the other kindred Schools throughout the United Kingdom. The position it has taken is shown by the number of Prizes it has obtained, and the amount of money that is paid to it for results. My impression is, that never in the history of Schools of Art has the Dublin School been more prosperous, or so prosperous as it is now; and that I attribute to its being administered on sound principles, and to its having the luck of an excellent Master; and I don't hesitate to say as a positive fact, that the Dublin School of Art is a great deal better than the Ecole de Dessin in Paris."

During the year a choice set of Casts has been added to the collection of the School. They are chiefly specimens of the antique period from the British Museum.

Many drawings and books have been received on loan, for various periods of time, from the Department of Science and Art; and are calculated to be of the greatest value for reference and study. The drawings include Original Studies from the Life, by Mulready and Etty; and Landscapes by David Cox, Holland, Prout, Pyne, &c.; Books of Photographs of the Monastery of Bathala, in Portugal; the Church of Santiago, in Spain; Henri Dieux Ware, Ecclesiastical Metal Work, and Italian Jewellery; together with Etchings and Chromo-lithographs of many of the most rare and beautiful objects of Art workmanship in the South Kensington Museum.

A collection of nine Fan Designs, purchased by the Department from the great Exhibition of Paris, were recently lent, and were on view in the School of Art for one week.

As regards the studies that have been pursued in the School during the past year, we may remark that Modelling in Clay of the human figure has been cultivated with great success. Painting from the Living Model and Still Life, and Drawing from the Antique in Chalk have also been much practised—studies invaluable as leading to exactness, and affording a complete power of execution.

Designing for Manufacturers has been steadily pursued by a considerable number of Students; and many very beautiful designs of the highest order of merit, and which few Schools in Europe could surpass, have been produced, more particularly for Wall Decoration, Tabinets, Muslins, and Pottery. The Prizes that have been offered by Messrs. Sheridan, of Parliament-street, and Messrs. Walpole, of Suffolk-street, together with the manufacture of designs by our Students by Messrs. Fry and Co., tend much to encourage this most important and interesting branch of Art education.

The attendance of Students during the year has been 538, consisting of 279 males, and 259 females.

The attendance of the Artisan Classes has been 356, consisting of 259 males, and 97 females.

The total receipt in fees amounted to £510 9*s.* 6*d.*

The following is an analysis of the occupation of Students :—

Analysis of the Occupations of the Students attending the School of Art at Dublin, during the year 1869.

Occupation.	No. of Students.	Occupation.	No. of Students.
Civil Service, ...	23	Editor of Newspaper, ...	1
Metropolitan Police, ...	1	Staymaker, ...	1
Ironmongers, ...	6	Coachmakers, ...	4
Builders, ...	13	Miner, ...	1
Jewellers and Silversmiths, . .	7	Builder's Pattern Maker, . .	1
Stationers, ...	8	Hatter, ...	1
Salesmen, ... ,	3	Land Steward, ...	1
Painters and Decorators, . .	15	Designer, ...	1
Coal Factor, ...	1	Engine Fitter, ...	1
Upholsterers, ...	8	Gas Fitters, ...	3
Plasterers, ...	2	Plumbers, ...	2
Photographers, ...	5	Engravers, ...	4
Merchants, ...	42	Soldier, ...	1
Glazier, ...	1	Watchmaker, ...	1
Architects, ...	8	Blindmakers, ...	2
Officers in the Army, ...	8	Cab Owner, ...	1
Sculptors, ...	2	Marble Mason, ...	1
Barristers, ...	8	Bookbinder, ...	1
Dentists, ...	2	Ship Carpenter, ...	1
Clerks, ...	21	Medical Doctors, ...	20
Bootmakers, ...	8	Landed Proprietors, ...	25
Lithographers, ...	9	Toolmakers, ...	6
Carpenters, ...	21	Art Teachers, ...	2
Smiths, ...	2	Druggist, ...	1
Clergymen, ...	19	Gunsmith, ...	1
Civil Engineers, ...	10	Fellow of College, ...	1
Stonecutter, ...	1	Actuary, ...	1
Musician, ...	1	Manufacturer, ...	1
Bricklayers, ...	5	Victualler, ...	1
Cabinetmakers, ...	9	Opticians, ...	2
Framers, ...	4	Milliners, ...	8
Surgeon, ...	1	Registrar of Schools, . . .	1
Solicitors, ...	29	Clothier, ...	1
Bankers and Bank Clerks, . .	8	Corkcutter, ...	1
Artists and Art Students, . .	11	Hotel Keepers, ...	2
Printers, ...	4	Clockmaker, ...	1
Porters, ...	2	Queen's Councillors, ...	4
Stonemasons, ...	4	Judge, ...	1
Agents, ...	9	Knights, ...	2
Hosier, ...	1	Viscounts, ...	2
Confectioners, ...	5		
Box Makers, ...	2		452
Labourers, ...	4	No. of Students unspecified, .	83
Schoolmasters, ...	5		
Turner, ...	1	Total, ...	535

The Local Examination of the School took place on the 9th, 10th, and 11th days of March, in the evening, when, notwithstanding the inclemency of the weather, 169 Students presented themselves; 105 of whom, 64 males and 41 females, succeeded in passing Examinations in 151 papers, consisting of 52 Freehand; 40 Practical Geometry; 24 Perspective; 32 Model Drawing; and 3 Projection. One hour was allowed for each paper.

The following table shows the relative success of Male and Female Students in the various subjects of Examination:—

Number of Male Students successful.

	Freehand.	Geometry.	Perspective.	Model Drawing.	Mechanical.
Passed, . .	27	16	4	21	2
Excellent, .	6	10	9	1	1
Total, .	33	26	13	22	3

Number of Female Students successful.

	Freehand.	Geometry.	Perspective.	Model Drawing.	Mechanical.
Passed, . .	17	10	6	9	0
Excellent, .	2	4	5	1	0
Total, . .	19	14	11	10	0

The following Students deserve particular mention as having passed at this Examination in the four subjects required for the Full Certificate, viz., Emily B. Hamilton, Mary Ann M'Gee, and Parke B. Dobson.

Students successful in "Passing" a paper obtain a Certificate Card; those gaining "Excellent," a Prize; but one or more Prizes gained in the one Examination are represented by one award. To those who complete the four subjects a "Full Certificate" is given.

The following gentlemen, members of the Fine Arts Committee, &c., superintended the Examination:—

Lieut.-Colonel Adamson; H. D. Hutton, Esq.; Judge Kelly; Robert Griffin, Esq.; John R. D'Olier, Esq.; William M'Kay, Esq., LL. D.; Sir Robert Harty; Robert Callwell, Esq.

The works of the Students in Drawing, Painting, and Modelling were forwarded to London on the 12th of April, as follows:—

Works in Elementary stages, consisting of Drawing from Flat examples, Mechanical and Architectural Drawing, Drawing from Geometric Models and Objects of Utility, from casts of Ornament, and Flowers, and Foliage from Nature.

89 Works, executed by 54 Students.

Works in Advanced stages, consisting of Drawing, Painting, and Modelling of the Human Figure (from Life and the Antique), and of Ornament and Animals; Painting of Flowers, Foliage, and Still Life from Nature; Architectural, Surface, and Plastic Design, &c.—118 Works, by 45 Students.

Class Exercises, consisting of Outlines of Figure, Ornament, Solid Models, Practical Geometry, Perspective and Projection, &c.—211 Works.

45 Works in the advanced stages, which are alone eligible, were selected to enter the National Competition. The appended Table shows the position held by the Dublin School, as contrasted with the leading Art Schools of the United Kingdom:—

	Princess of Wales's Scholarship.	Gold.	Silver.	Bronze.	Queen's Prizes.
South Kensington, ...	1	3	6	12	21
Dublin, ...	1	1	2	2	5
Edinburgh Male, ...	–	–	1	3	8
,, Female, ...	–			2	2
Nottingham, ...		1	2	4	4
Lambeth, ...	–	1	1	3	1
Sheffield, ...		1		2	1
Glasgow, ...	–	1		1	1
Manchester, ...	–			4	5
Birmingham, ...	–			1	3
Liverpool, ...					2
Leeds, ...					1

The total number of Schools competing was 101, of which 28 received National Medal awards.

To the Schools of South Kensington and Dublin, the two Princess of Wales's Scholarships have been again this year awarded.

The names of those Students of the Dublin School who were successful in the National Competition, together with the description of study to which Awards were made, are as follows:—

Miss Frances Jordan, Princess of Wales's Scholarship and Gold Medal for Original Designs for Muslins.

Mr. Wm. Millard, Silver Medal, for Model from the Life of a Female Head.

Miss Charlotte Benson, Silver Medal, for a Group painted in Oil Colour from Nature.

Mr. Edward Gibson, Bronze Medal, for a Study in Low Relief of a Female Head from the Life.

⁂ To Mr. Edward Gibson was also awarded a Free Studentship.

Miss Frances Brett, Bronze Medal, for an Original Design for Wall Decoration.

Mr. Wm. Perry, Queen's Prize for Head of Female painted in Oil from the Life.

Miss Susan Ball, Queen's Prize for an Original Design for Wall Decoration.

Mr. Sylvester Reilly, Queen's Prize for a Drawing of a Machine from actual Measurement.

Miss Maria D. Webb, Queen's Prize for a Group painted in Oil from Nature.

Miss Elizabeth Wallace, Queen's Prize for an Original Design for a Fan.

The Examiners were—Sir Francis Grant, P. R. A.; J. C. Horsley, R. A.; R. Westmacott, R. A.; F. R. Pickersgill, R. A.; M. D. Wyatt; F. J. Poynter, A. R. A.; R. Redgrave, R. A., and H. A. Bowler, Official Inspector.

To those studies not entering into National Competition, twenty-two third or Highest Grade Prizes were awarded, together with one Honorable Mention.

Dr. Alexander Macalister, Professor of Artistic Anatomy to the Royal Dublin Society, delivered a Course of Eight Lectures in June last, to the Students, and upon the completion of the Course an Examination was held. The following is Dr. Macalister's Report:—

"I have to report that I held the Examination at the end of my Course of Lectures on Anatomy, and that the answering was excellent.

"The first place was taken by Mr. O'Farrell, who scored 75 per cent.; the second by Miss Isabella Maffett and Miss Kate Josephine O'Brien, who were equal. I would beg to suggest, that in consideration of the good answering both these ladies should receive Second Medals.

(Signed) "Alex. Macalister."

Examination in Artistic Anatomy, 28th June, 1869. Maximum Marks, 100.

		No. of Marks.
Roderick O'Farrell,	First Silver Medal, .	79
Isabella Maffett, K. Josephine O'Brien,	Second Silver Medal, .	70

The Adjudication of Medals offered by the Royal Dublin Society took place upon the 23rd day of December; the following works were submitted:—

	No. of Works.
Class 1.	
Groups in Oil, ...	4
Painting of Heads from the Life, . . .	12
Full-length Antique, ...	5
Head, Hand, and Foot, from the Antique, .	19
Anatomical Studies, ...	4
Class 2.	
Modelling in Clay from the Life, . . .	8
Do. from the Antique, . . .	4
Class 3.	
Design for Tea Service, ...	3
Muslins, ...	8
Axminster Carpet, ...	1
Wall Decoration, ...	15
Poplins, ...	4
Royal Chair, ...	1
Mirror Frame, ...	2
Kidderminster Carpet, ...	3
Class 4.	
Public Building, ...	2
Parish Church and Gateway, ...	2
Machinery from Measurement, ...	6
Geometry, ...	32
Perspective, ...	4
Projection, ...	4
Class 5.	
Landscape from Nature, ...	49
Animals, ...	4
Class 6.	
Groups in Chalk from the Round, . . .	18
Total, ...	214

REPORT

Of the Judges of the Works executed in Competition for the Society's Prizes.

Your Committee, in making their Examination of the Works submitted in competition by the Students of the Schools of Art, have, on this occasion, to report most favourably as to the improvement made in many of the Sections, and more particularly in

Class III., which refers to Art as connected with Manufactures. Among these the designs for Porcelain, Muslins, and Wall Decoration, evince a degree of correct taste in form, composition, and colour, highly creditable to the Students.

In recording this satisfactory progress, we have to express our regret that we have been unable to take into consideration several Works by the Assistant Art Teachers, they being exhibited in an unfinished state. Ample notice of the time of the intended Adjudication having been given, there appears no reason why these Works should not have been completed, so as to enable us to record their respective merits.

We cannot conclude our Report without expressing our appreciation of the zeal and ability of the Head Master, Edwin Lyne, Esq., whose successful efforts in the discharge of his arduous duties have doubtless mainly contributed to the satisfactory progress witnessed in our inspection.

The following are our awards :—

A Special Silver Medal to Mr. Edmond Ribton Byrne for a Group in Oil Colour from Nature.

CLASS I.

Sec.	Names.	Prizes.
1.	Maria D. Webb (Painting in Oil from the Life),	*First Silver Medal.*
	William Perry (recommended),* do.,	*Second Silver Medal.*
2.	K. Seymour (Monochrome from the Antique, full length),	*First Silver Medal.*
3.	Jane Garbois (Head, Hand, and Foot, in Chalk) (Antique),	*Second Silver Medal.*
	Mary Ann Morgan (recommended),* do.,	*Bronze Medal.*
4.	Mary Ann Morgan (Anatomical Drawing),	*Second Silver Medal.*

CLASS II.

1.	James Boyle (Modelling from Life),	*First Silver Medal.*
	Robert Smith (recommended),* do.,	*Second Silver Medal.*
2.	Edward Bestick (Modelling from the Antique),	*Second Silver Medal.*

CLASS III.

1.	Minnie Mahony (Original Design, Pottery),	*First Silver Medal.*
	Frances Brett,	*Honorable Mention.*
2.	No Competition (Set of Jugs).	
3.	Kate Seymour (Original Design, Muslins),	*Second Silver Medal.*
4.	Elizabeth Irwin (Original Design, Carpets),	*First Silver Medal.*
5.	Isabella Bergin (Original Design, Wall Decorations),	*First Silver Medal.*
	Frances Brett (recommended),* do.,	*First Silver Medal.*
	Emily Frances Poole (recommended),* do.,	*Bronze Medal.*
	Marcella Irwin (recommended),* do.,	*Bronze Medal.*
6.	Bridget M'Gloin (Original Design, Poplins),	*First Silver Medal.*
7.	(Regal Chair).	
8.	Thomas Scott (Original Design, Mirror Frame),	*Second Silver Medal.*

For the Money Prize offered by Mr. Peter Sheridan for a design of a Kidderminster Carpet we approve of the Work of Miss Marcella Irwin.

CLASS IV.

1.	James Lynch (Architecture, from Measurement),	*Second Silver Medal.*
2.	(Parish Church).	
3.	Henry Hall (Machine Drawing, from Measurement),	*First Silver Medal.*
	Sylvester Reilly (recommended),*	*Bronze Medal.*
4.	Thomas Tatton (Geometry),	*First Bronze Medal.*
5.	Anthony Scott (Perspective),	*First Bronze Medal.*
6.	Anthony Scott (Projection),	*First Bronze Medal.*

CLASS V.

1.	James M'Donnell (Landscape from Nature in Oil),	*First Silver Medal.*
	Maria D. Webb (recommended),* do.,	*Second Silver Medal.*
	Isabella Moffat (recommended),* do.,	*Bronze Medal.*

* Additional Prizes recommended by the Judges, and subsequently approved by the Committee.

CLASS VI.

1. Mary Ann M'Gee (Models in Chalk),	*First Bronze Medal.*
2. Parke B. Dobson (recommended)*, do.,	*Bronze Medal.*
3. Marcella Irwin (recommended)*, do.,	*Bronze Medal.*

(Signed)
GEORGE HODSON, BART.
CATTERSON SMITH.
THOMAS NEWENHAM DEANE.
GEORGE COLOMB, *Lieut.-General.*

December 23*rd*, 1869.

We desire to return our best thanks to the Judges for their trouble and kindness in attending to make the Awards.

The Worshipful Company of Plasterers of London have offered the following Prizes to Students of Schools of Art, to be competed for previous to April, 1870.

A MODEL IN PLASTER.

An Original Design for the ornamental capital of a pilaster 14 inches high, 12 inches in greatest width, and 2 inches thick at necking.

	£	s.	d.
For the best,	£8	8	0
For the second best,	5	5	0

A DESIGN IN MONOCHROME.

An Original Design for the filling in of a diaper, in low relief of a wall. The subject to be taken from the leafage of any one plant or flower—to be treated conventionally.

	£	s.	d.
For the best,	£7	7	0
For the second best,	4	0	0

An exhibition, the most considerable ever held, of the Students' works, took place in the School of Art during the Christmas vacation, and was visited by 1266 persons.

In concluding this Report we may, perhaps, venture to remark upon the increasing recognition of education in drawing as a necessity amongst all ranks of society; and that love of Art that was formerly experienced by the few which is now so largely diffused amongst all classes; even amongst those whose lives are passed in material occupations.

There are few periods of history of which the productions and remains are not at the present day the object of assiduous research; their study has become a national want, and examples of every period of Art development have acquired a value incalculable; the investigation of the great historic epochs, and the chronological succession of progress, of transition, and decadence; and the comparison of the productions of skilled industry of various periods by the different races of mankind, furnish to producers of every kind lessons the most valuable, and data, facilitating the practical application of design to the various requirements of the day.

The above considerations have impressed upon us the importance of establishing as early as possible, a Museum in connexion with our Schools—such as might prove practically useful to Students and others, more particularly in the application of design to manufactures—not with a view to imitation, but rather to evolve those leading principles common to Art in all ages; for it is rare that the direct revival of a style of any past period, so common amongst us, is consistent with present requirements.

In our own day the introduction of steam power and increased mechanical production, has led to changes sudden and continual in nearly every branch of Art industry; and this rapidity of production, as compared with the slower and more artistic works of the hand of former periods, has led to much that is in bad taste, and inappropriate in style. When, however, mechanical operations shall have so far improved as to enable machinery to do the bidding of the artist with increased effect, new phases of development will succeed, and applied Art will enter more largely into every branch of industry.

The desirability of such a result it is needless to insist upon; Art in contact with industry enhances the value of the material, ten, twenty, a thousand-fold, and an object of small intrinsic value, by the intervention of Art, becomes an object the most precious—not so much by the quantity of the embellishment, as by the propriety of its application; being applied at times with munificence, at others, with discreet economy. Since machinery is every day replacing more and more the hand of man, how necessary that the artist should give increased consideration to the new rapid and hasty methods of production of our day: and how desirable also that science should enable machinery to translate more completely the motives of the artist, in order that decoration, superadded to utility, and applied to objects and materials the most common, may lead to that desirable consummation, the presence of the beautiful in every cottage in the land.

(Signed) J. S. Adamson, Lieut.-Colonel, Chairman.

Dr. Steele, the Registrar, then read the List of Prizes, and on the Students approaching the Chair, His Excellency delivered the Prizes into the hands of each.

PRIZES

AWARDED BY THE DEPARTMENT OF SCIENCE AND ART.

PRINCESS OF WALES' SCHOLARSHIP.

Name.	Stage.	Subject.
Jordan, Frances, . .	23*c*,	*Designs for Muslin.*

NATIONAL GOLD MEDAL.

	Stage.	
Jordan, Frances, . .	23*c*,	*Design for Muslin.*

NATIONAL SILVER MEDALS.

	Stage.	
Benson, Charlotte E., .	15*a*,	*Group in Oil Colours from Nature.*
Millard, William,. .	19*d*,	*Model of a Female Head from the Life.*

NATIONAL BRONZE MEDALS.

	Stage.	
Brett, Frances, . .	23*c*,	*Design for Wall Decoration.*
Gibson, Edward, . .	19*d*,	*Model in Low Relief of Female Head.*

QUEEN'S PRIZES.

	Stage.	
Ball, Susan, . . .	23*c*,	*Design for Wall Decoration.*
Perry, William, . .	17*b*,	*Female Head from the Life in Oil.*
Wallace, Elizabeth, .	23*c*,	*Design for a Fan.*
Webb, Maria D., . .	15*a*,	*Group painted in Oil Colour from Nature.*
Reilly, Sylvester, . .	23*a*,	*Drawing of a Machine.*

SELECTIONS FOR NATIONAL COMPETITION.

	Stage.	
Aitken, J. Alfred, . .	14*b*,	*Landscape from Nature.*
Ball, Susan, . .	23*c*,	*Design for Wall Decoration.*
Benson, Charlotte, . .	15*a*,	*Group in Oil Colour from Nature.*
Benson, Sarah Ismena, .	4*b*,	*Vatican Car in Chalk.*
Brett, Francis, . .	8*b*(1), 23*c*,	*Head from Antique in Chalk.* *Original Design for Wall Decoration.*
Everth, Harriet, . .	15*a*,	*Group in Oil Colour from Nature.*

	Stage.	
Fitzgerald, Michael,	8b(2), 14b, 8d, 17b,	*Drawing in Chalk of Son of Laocoon.* *Sketches of Figure (Nature).* *Landscape from Nature.* *Head from the Life in Oil Colour.*
Gibson, Edward,	8b(1), 19d,	*Head of Ajax (Antique) in Chalk.* *Modelling Female Head in Low Relief.*
Irwin, Elizabeth,	23c,	*Original Design for Carpet.*
Jordan, Frances,	23c,	*Do. do. for Muslin.* *Do. do. for Wall Decoration.*
Millard, William,	19d,	*Female Bust from Life modelled in Clay.*
Macdonnell, James,	14b,	*Landscape in Oil painted from Nature.*
M'Gloin, Bridget,	23c,	*Original Designs for Muslins.*
Morgan, Anne Mary,	9a,	*Anatomical Studies of the Human Figure in Sepia.*
Moran, James E.,	23d,	*Original Plastic Design.*
Mahony, Minnie,	23d,	*Original Design for Pottery.*
Nicholson, Ruth E.,	23c,	*Do. do. for Wall Decoration.*
	23d,	*Do. do. for Pottery.*
O'Brien, Kate,	19b, 19d,	*Head of Homer modelled from the Antique.* *Female Head modelled from Life.*
O'Farrell, Roderick,	8b(2),	*Drawing in Chalk of the Fighting Gladiator.*
Perry, William,	17b,	*Female Head painted from the Life in Oil.*
Ruxton, Anna F.,	23c,	*Original Design for Poplin manufactured by Messrs. Fry and Co.*
Reilly, Sylvester,	23a, 23b,	*Drawing of a Machine, from actual measurement.* *Drawing of a Public Building, from actual measurement.*
Smith, Robert S.,	19b,	*Head modelled from the Antique in Clay.*
Seymour, Frances,	17b,	*Female Head painted from the Life in Oil Colour.*
Seymour, Kate,	14b, 16a, 17b, 23c,	*Landscape from Nature in Water Colour.* *Painting in Monochrome from the Antique.* *Female Head painted from the Life in Oil Colour (2 Works).* *Original Design for Muslins (2 Works).*
Spring, Francis,	23c,	*Do. do. for Wall Decoration.*
Wallace, Elizabeth,	14a, 23c,	*Flowers painted from Nature in Water Colour.* *Original Design for Muslins.*
Webb, Maria D.,	14b, 15a,	*Landscapes painted from Nature in Oil Colours.* *Group painted in Oil from Nature.*

THIRD OR HIGHEST GRADE PRIZES.

	Stage.	
Aitkin, James,	14b,	*Landscape in Oil Colours from Nature.*
Baker, Leslie,	6a,	*Farnese Hercules enlarged, in Outline.*
Benson, Sarah Ismena,	4b,	*Vatican Car, in Chalk.*
Cox, Lizzie,	5b,	*Group of Models shaded in Chalk.*
Carson, Josephine,	5a,	*Do. do. do. do.*
Dobson, Parke B.,	2b,	*Trajan Scroll, enlarged in Outline from the Flat.*
Fitzgerald, Michael,	8b(2), 8e,	*Chalk Drawing of the Son of Laocoon from the Cast.* *Sketches of the Figure from Nature in Pencil.*
Gibson, Edward,	8b(1),	*Head shaded in Chalk from the Antique.*
Kelly, Henry,	5a,	*Group of Models from the Round shaded in Chalk.*

	Stage.	
Margetson, Frederick,	2*b*,	*Outline Drawing of Tarsia, enlarged.*
Maffatt, Isabella,	4*b*,	*Shading Ornament from Flat Examples.*
Morgan, Mary A.,	9*a*,	*Anatomical Studies of the Human Figure in Water Colour.*
O'Hanlon, Julia,	5*a*,	*Group of Models in Chalk from the Round.*
O'Brien, Kate,	19*d*,	*Model in Clay of Female Head from the Life.*
Roberts, Minnie,	5*a*,	*Group of Models shaded in Chalk from the Round.*
Parkinson, Amelia,	9*a*, 6*a*,	*Anatomical Studies of the Human Figure in Water Colours.* *Furnese Hercules enlarged in Outline from the Flat.*
Ruxton, Anna F.,	23*c*,	*Original Design for Hangings.*
Smith, Robert S.	19*b*,	*Head modelled from the Antique.*
Smith, Francis,	2*b*,	*Tarsia in Outline enlarged from the Flat.*
Seymour, Frances,	17*b*,	*Female Head painted from the Life in Oil Colour.*
Seymour, Kate,	17*b*,	*Female Head painted from the Life in Oil Colour (two Works).*
Wallace, Elizabeth,	14*a*,	*Flowers painted in Water Colour from Nature.*

HONOURABLE MENTION.

	Stage.	
Conan, Jeanie,	5*a*,	*Group of Models shaded in Chalk from the Round.*

FULL CERTIFICATES (SECOND GRADE).

Benson, Sarah Ismena.
Brett, Elizabeth Mary.
Dobson, Parke B.
Dowling, Richard.
Hamilton, Emily B.
Higgins, Patrick Joseph.
M'Dermott, Madeline.
M'Gee, Mary Ann.
Manning, John R.
Moulang, Thomas H.
Reilly, Sylvester.
Smith, Robert S.
Smith, Charles.
Wallace, Elizabeth.

SECOND GRADE PRIZES.

Bashford, C. S.,	*Perspective.*
Bashford, George,	*Geometry.*
Beardwood, John,	*Do.*
Benson, Sarah Ismena,	*Model.*
Boxwell, Susan,	*Do.*
Carson, Josephine,	*Geometry.*
Cathrew, Mary,	*Freehand.*
Dobson, Parke B.,	*Freehand and Geometry.*
Freeman, Denis W.,	*Freehand.*
Gordon, Edward F.,	*Geometry.*
Hamilton, Emily B.,	*Geometry, Perspective, and Model.*
Hogg, Anna,	*Geometry.*
Johnston, Joseph,	*Do.*
Kelly, Henry,	*Geometry and Perspective.*
Leonard, John,	*Geometry.*
M'Dermott, Madeline,	*Perspective.*
M'Gee, Mary Ann,	*Freehand.*
M'Guire, Matthew,	*Do.*
Manning, John R.,	*Perspective.*
Margetson, Frederick.	*Freehand.*
Middleton, David,	*Geometry.*
Maffatt, Isabella,	*Do.*

Moulang, Thomas Henry,	*Geometry and Perspective.*
Reilly, Sylvester,	*Freehand and Model.*
Scott, Anthony,	*Perspective.*
Smith, Joseph C.,	*Do.*
Smith, Robert S.,	*Do,*
Smyth, Charles,	*Do.*
Smyth, Emilie L. D.,	*Do.*
Spencer, Arabella,	*Do.*
Thompson, T. C.,	*Geometry.*
Tobias, John D.,	*Freehand.*
Williams, Alexander,	*Perspective.*

SECOND GRADE CERTIFICATES.

Abrahams, Phineas,	*Freehand.*
Alexander, Mary E.,	*Do.*
Alston, James,	*Geometry and Model.*
Baker, Leslie,	*Freehand.*
Bagot, Amy,	*Geometry.*
Ball, Susan,	*Freehand.*
Barlow, Dora,	*Do.*
Bashford, C. S.,	*Do.*
Beardwood, John,	*Do.*
Bermingham, Christopher,	*Model.*
Boucher, James Waller,	*Freehand Geometry, and Perspective.*
Brenan, Elizabeth,	*Freehand.*
Brett, Elizabeth Mary,	*Geometry and Perspective.*
Brett, Nannie,	*Freehand.*
Butler, John,	*Geometry.*
Byrne, Thomas,	*Do.*
Campbell, Walter H.,	*Freehand, Geometry, and Model.*
Coffey, William Henry,	*Freehand.*
Comerford, James,	*Do.*
Cox, Lizzie,	*Perspective.*
Dobson, Parke B.,	*Perspective and Model.*
Dowling, John E.,	*Freehand.*
Dowling, Richard,	*Model.*
Fitzgerald, William,	*Freehand.*
Freeman, Denis W.,	*Geometry.*
Fuller, Elizabeth Mary,	*Freehand and Geometry.*
Garbois, Jane,	*Do.*
Geary, John,	*Perspective.*
Geoghegan, Frances A.	*Model.*
Goodbody, Hannah P.,	*Freehand.*
Gordon, Edward F.,	*Do.*
Hackett, Ellen Agnes,	*Geometry and Perspective.*
Hamilton, Emily B.,	*Freehand.*
Higgins, Patrick Joseph,	*Model.*
Hogg, Anna,	*Freehand.*
Hoolahan, Richard,	*Do.*
Johnston, John P.,	*Geometry and Model.*
Johnston, Joseph,	*Model and Mechanical.*
Kehoe, Sarah,	*Freehand.*
Kelly, Henry,	*Model.*
Kenney, R. H.,	*Geometry.*
Kent, Edward,	*Freehand.*
Kerrigan, Joseph P.,	*Model.*
King, Caroline M.,	*Perspective.*
Kirkwood, Margaret S.,	*Freehand.*
Leonard, John,	*Do.*
Lynch, James,	*Do.*
M'Donald, Samuel,	*Model.*

M'Gee, Mary Anne,	*Geometry, Perspective, and Model.*
M'Guire, Matthew,	*Model.*
M'Guire, William A.,	*Freehand.*
M'Kee, Fanny,	*Do.*
Mahon, Julia E.,	*Geometry.*
Manning, John R.,	*Model.*
Margetson, Frederick,	*Do.*
Millard, Joseph,	*Freehand.*
Milligan, John,	*Freehand and Geometry.*
Moffett, Isabella,	*Freehand and Model.*
Moulang, Thomas H..	*Model.*
Munro, John,	*Freehand.*
Murphy, Marius L.,	*Do.*
Murphy, Mary F.,	*Perspective.*
Nolan, John Joseph,	*Geometry.*
Norton, Anna,	*Model.*
O'Brien, Kate Josephine,	*Geometry.*
O'Hanlon, Julie L. E.,	*Model.*
O'Neill, James J.,	*Do.*
O'Neill, Robert H.,	*Do.*
Osborne, William,	*Geometry.*
Overend, Henry B. L.,	*Perspective.*
O'Hanlon, Amelia,	*Model.*
Reigh, John,	*Model.*
Reilly, Sylvester,	*Geometry.*
Roberts, Minnie,	*Model.*
Sankey, Alfred,	*Freehand.*
Scott, Anthony,	*Mechanical.*
Seadon, William,	*Freehand.*
Sherwood, James,	*Freehand and Geometry.*
Smith, Joseph C.,	*Freehand and Model.*
Smith, Stanislaus,	*Freehand.*
Stephens, Lizzie,	*Freehand.*
Tatton, Thomas,	*Freehand, Geometry, and Model.*
Thornhill, Harriett A. M.,	*Geometry.*
Todd, Jane E.,	*Perspective.*
Wallace, Elizabeth,	*Geometry.*
Webb, John,	*Do.*
Wilkins, Mortimer,	*Freehand.*
Williams, Oliver,	*Do.*
Wilson, Marian,	*Do.*
Young, William,	*Geometry.*

The Prizes awarded by the Society, a List of which is given at page 529, were then distributed.

Lord Powerscourt then proposed a vote of thanks to His Excellency for his kindness in presiding, and also to Lady Spencer for her presence on the occasion. He said that it was sometimes thought by those gifted with natural talent, that they could excel without study. But he would remind students that no one attained the excellence of a Landseer, or a Millais, without a life of study. Schools such as this were of the greatest benefit in directing natural talent into a proper channel.

The Marquis of Kildare supported the proposal, and on the part of the Council expressed their appreciation of His Excellency's kindness in presiding at that meeting.

His Excellency said,—My Lords, Ladies, and Gentlemen, I thank you very sincerely for the kind manner in which you have received the proposition made by Lord Powerscourt, and seconded by Lord Kildare. I may assure you that it gives me infinite pleasure to be here a second time on this important occasion. I well remember with what interest I came here last year, and was allowed, from my position as humble representative of our most gracious Queen, to take part in this ceremony—I well remember with what interest I took part in the proceedings of that day ; but I may assure you that that interest has not faded away from my having been in Ireland for now more than a year. I feel that the progress of Art in this country is advancing very rapidly; and I know from the large assembly before me that the public in this important city feels deeply anxious about the progress of Art, so well promoted by the labours of the Royal Dublin Society. I am happy to say that this particular School has made considerable progress even in the past year. I was able last year to congratulate the Scholars of this School on having attained one of the highest distinctions offered by a kindred Museum—namely, one of the Scholarships known by the name of the Princess of Wales' Scholarship. I am happy to say that the good example Miss Brett showed last year has been followed this year, and that Miss Jordan has also become a Scholar of the Princess of Wales. I may congratulate this Board upon her success; but I hope that the success that has attended the Scholars of this School will continue, and that others in succeeding years will attain similar honours. In comparison with last year, there has been a considerable increase in the attendance of the Students. Last year 519 Students attended—this year there were 538, showing an increase of 3 per cent. Among the artisan class I observe that there has been a still greater increase—the numbers last year being 201, while this year they are 356. That I think is very favourable, and very satisfactory; for one of the chief benefits of institutions of this sort is, that it gives opportunities to the poorer classes to develope their talent in Art, and they have talent in Art just as much as the higher and middle classes. Such institutions, I say, give them an opportunity of developing their genius and talent. I am glad to know that the artisans of Dublin have availed themselves so very freely of the excellent School that has been given to them. I am happy to hear from Mr. Maunsell and Colonel Adamson, who ably presides over the Committee, such an excellent account of the conduct of the Pupils. I rejoice very much to hear the complimentary remarks paid to their Master, and I may say that I have additional pleasure in hearing them, for Mr. Lyne belongs to the same county as I do in England, and I believe he was brought up within a few miles of my country place. I feel that nothing has been more remarkable than the rapid increase in the love of Art throughout England, and Scotland, and Ireland, during the last few years. I hardly know to what to attribute it. In one way it has been increased in consequence of the large facilities that have been given to all classes to travel in distant lands, and to see the treasures that have been collected by the great masters of bygone days. Formerly those privileges were extended to the richer and upper classes; and though the richer and upper classes are entitled to much credit for having brought treasures to this country, still it is an advantage that others may go to the fountain head themselves, and see those great works which every country so glories to preserve. Another thing that gave a great start to Art in this country was the idea of holding a great Exhibition, which attracted so much attention in 1851. From that time may be dated a great improvement in all that concerns Art in this country. At that Exhibition we were obliged to confess that, though we excel in manufactures, yet we fell far behind other nations in many respects, and we learned from them what advantage it was to cultivate high Art and good taste in regard to manufactures. I believe that Exhibition gave a great impetus and start to manufactures in this country, and the artistic feeling which now happily is so improving in that respect. One of the most practical shapes which the movement has taken has been in the establishment of Art Classes throughout the country. Not only are these Art Schools places where the artist may learn to execute works of the highest perfection, and on canvas or marble develope his abstract idea of beauty, but they give lessons which greatly improve taste in designs and manufactures. That I conceive to be of great importance; for the value of our manufactures is increased both at home and abroad if they are designed in good taste, and further opportunity is given to the development of higher Art. You may find many instances where those who first entered these Schools of Art to make themselves more efficient workmen in manufactures, have discovered that they had superior talents and large genius, and hence aspired to become great artists. Many of you may have instances before you of this at the present time. I cannot help referring to one of the most distinguished sculptors of our day—John Gibson. He rose from a very humble origin, and when he first started in life he had not the means to obtain a high Art education. He, therefore, went into the business of cabinet-maker. He then found time to copy prints he saw, in the shop windows in Liverpool, and he got some money by the drawings which he produced. He then found he had a great skill for carving, and he began to carve in wood; but he was not long satisfied with that; for he went into a marble-cutter's manufactory, and soon distinguished himself by the beauty and excellence of his designs in marble. He got introductions to several lovers of Art; and he was sent to Rome, where he studied under the best sculptors, and finally rose to the highest eminence. I quote this to show that not only do these Schools directly improve the tastes of manufacturers, but they enable men to develope their genius, if genius they have, for high Art. I am glad to see in the Report which I hold in my hand that during the past year the Students of these Schools have had the advantage of copying some of the works of the best living artists. The greatest importance is to be attached to having works of the very highest excellence brought before the eyes of those who are studying Art, and I believe it is of immense advantage to the Students of this School to have had the loan of these works. In some respects Dublin is at a disadvantage with regard to Exhibitions. In London and elsewhere there are admirable collections of pictures, sculptures, and other works of Art; and though in Dublin there are several similar institutions which have works of great excellence, I confess that I should like to see a larger collection of Works of Art for the instruction of the Students of these Schools. The managers of the National Gallery have with much public spirit undertaken to have an Exhibition of the Works of the great Masters, and I may only say that it was with the greatest possible pleasure I was able to bring some works from England to assist this Exhibition. I would commend to the Students of this School the importance of studying the best works of old Masters. They will get the greatest possible advantage from it. If they make a copy four or five times over of one of the works of the old Masters of the best description, it would do them much more good than to copy eight or ten drawings of an inferior kind. The importance of this has been shown more than once in this country; for I dare say you have often heard—you will forgive me for repeating it if you have heard it before—a story which shows the importance of having a good example before those who may visit exhibitions. I wish, then, to remind you of a story told of Cork. When one of our kings landed there on a certain occasion, he told the people of the town that he had received ftom the Vatican a very important collection of casts, and did not know where to place them. A gentleman who was ready for the occasion, and who had the welfare of the town of Cork at heart, asked his Majesty whether he would not send the collection to Cork. His Majesty was graciously pleased to give the collection to Cork. Owing to this gift, a very fine collection of casts is to be seen in that town; and it is said that more than one great artist attributes his commencement of Art to having seen this collection in his native town. Foley and Maclise, who bring great renown on this country, have said that their first start in Art began at Cork, when they visited this Museum. I will not detain you any longer—I thank you sincerely for the kind way in which you have listened to my few remarks. I know that this Society has a noble work in hands—that no nobler work can any body of gentlemen have in hands than that of raising the Art feeling in the country. The love of Art and the knowledge of Art not only give individual pleasure to those who possess it, but they are thereby able to comprehend and understand the beauties of nature in a way which they never could before. Both the love of Art and the knowledge of Art greatly increase the civilization and aspirations of nations, and I cannot imagine a nobler task than that of encouraging it in Ireland. I may assure you that the encouragement of Art in this country is one of the objects I most sincerely have at heart.

EVENING SCIENTIFIC MEETINGS.

MONDAY EVENING, NOVEMBER 15, 1869.

SIR D. J. CORRIGAN, BART., in the Chair.

Mr. W. **ANDREWS**, Chairman of the Natural History Committee, read a paper on Deep Sea Soundings.

Mr. A. G. **MORE**, Assistant in the Museum of Natural History, exhibited a collection of rare Zoological Specimens made by him in Connemara for the Museum.

Mr. W. F. **KIRBY**, Assistant in the Natural History Museum of the Society, communicated a paper entitled "A Natural History Excursion on the Continent in the Spring of 1869." A large collection of Insects captured by him during the excursion was at the same time exhibited.

An account of a Recent Meteor was given by **HOWARD GRUBB**, C. E.

A fine Engraving of the Nebula in Orion, as seen in the Great Telescope at Parsonstown, and presented to the Society by the Earl of Rosse, was exhibited.

A large Electro-Magnet was also exhibited.

MONDAY EVENING, DECEMBER 20, 1869.

GEO. JOHNSTONE STONEY, A. M., F. R. S., in the Chair.

Mr. JOHN **ADAIR** read a paper on the Acclimatizing of Plants as a help to Civilization.

In the course of the discussion, Dr. **BARRY** said that part of the Botanic Garden at Adelaide, in Australia, was set aside for the acclimatizing of plants. Some years ago the mulberry was introduced, and succeeded very well. When the plants appeared likely to succeed, they introduced silkworms, and freely distributed them to any one who was willing to try to rear them. Dr. Barry had recently received a fine sample of silk from Australia; and so much was already produced there that it was likely soon to become an article of export. He brought many plants from Australia, but had lost the greater part from over-nursing. He gave some of the seeds of a beautiful kind of pea, very common in Australia, to a friend of his, who tried to rear them in a warm place. The seeds germinated indeed, but withered, without flowering.

Mr. **FERGUSON** wished that Mr. Adair had spoken of the introduction of conifers and other large trees, which would greatly improve both the scenery and the climate. Wine was produced from a vineyard at Blackrock, 150 years ago.

Dr. **MOORE**, Director of the Botanic Garden, complimented Mr. Adair highly on the object of his paper. He did not quite understand whether Mr. Adair spoke merely of introducing plants, or of altering their nature to make them bear a different climate. If the latter, it was against both his theoretical and practical knowledge. He knew of no plant which was hardier now than it was the first day it was introduced. It was true that the wood of foreign trees sometimes became hard, and flowers and fruit were produced; but this was not because the plant had become more hardy, but because the summer had been hotter. The potato was not hardier to-day than it was when introduced. Dr. Moore visited Killarney at the time of the great frost of 1855, and found that the greater part of the arbutus trees, some of them twenty or thirty years old, had been killed, except in sheltered places. The rhododendron, to which Mr. Adair alluded, was not the genuine Himalaya species, but was crossed with a North American species; and even then it was scarcely hardy enough to bear the winter without a covering. Some rhododendrons which had been crossed with hardier species had become some of the greatest ornaments of our gardens. There were not many rhododendrons about Dublin, because they would not grow on a limestone soil; and it was a matter of great difficulty and expense obtaining a sufficient supply of peat to keep the rhododendrons at Glasnevin alive. It is well known that the peach is derived from the nectarine, and not an original plant. The public must not suppose that plants can be made more hardy by exposure; but many plants are really much more hardy than we suppose. All the plants exhibited by Mr. Adair come from climates which are colder than ours in the winter. A palm has been growing for forty-seven years at Edinburgh, it is true, but it is against a wall, with its roots fixed into it, and is killed down every winter, so that it is not more than a foot high. Many such plants might grow in Ireland till a severe winter came; but then they would be cut off, as he had noticed had actually occurred near Galway, where many foreign plants were growing in a sheltered place some years ago; but they were nearly all gone now. All the vines in the Botanic Gardens have to be protected. Plants will not always thrive best in sheltered places; for they are then exposed to the damp; and cold is much more liable to injure plants in damp situations than in dry. New Zealand is nearly our antipodes, and their seasons are the reverse of ours. The consequence is, that New Zealand plants have a natural tendency to commence growing just at the time when our climate is most unfavourable for it; and hence they get nipped off by the frost. The olive grows to the height of twenty or thirty feet in Spain; but it will not grow here without shelter in winter.

Mr. William Andrews, on being called on by the Chairman, said, that after the very elaborate review of climatal effects on Exotic Plants that had been given by Dr. Moore, long known for his practical and scientific experience of the subject, and the Professor of Botany of Trinity College being present, he should not enter into any physiological opinions, but merely state that he considered Mr. Adair's paper to be one of great interest, his object being to bring to notice the cultivation of plants that had always been maintained to be of too tender a nature to bear the severity of our winter seasons unprotected. He scarcely agreed with Dr. Moore that such destruction had occurred to the arbutus trees at Killarney, in the winter of 1855, the most severe that had been known for years previously or since. There were forests of the arbutus at Muckross, and numbers had existed for thirty or forty years, and no symptom of injury had affected them from climate. He was aware that a large bay tree had perished that winter, but it was aged, and its trunk unsound. The *Pinus palustris*, South Carolina swamp pine, had stood many severe winters at Killarney. He had had many communications from his friend, the late Right Hon. John Wynne, who had so much beautified the grounds of Hazlewood, near Sligo, and who had introduced so many trees and plants of interest. Mr. Wynne observed that the severity of that winter was great, and that during the most intense time of the frost no snow had fallen to afford cover to the plants. Some delicate pines and subtropical plants had without injury borne exposure to the severity of the winter. He (Mr. Andrews) had for several years cultivated New Zealand plants, suffering no check or injury during the winter. He had also grown a fine tree of *Eucalyptus globulus* that had braved several severe winters, and had attained to the height of thirty feet. It was destroyed by a strong wind, taking effect on its weighty leaves, tearing the tree from its support, and destroying the roots. He had seen the gardens in Paris, particularly that of the Prè Catalan, in the Bois de Boulogne, where a variety of subtropical plants had been introduced, and had grown without injury in a climate that had generally severe winters. That beautiful plant of the Cannæ tribe, *Thalia dealbata*, had grown there luxuriantly; and the gardens at Battersea Park had many subtropical plants thriving without winter protection. The graceful plant Bambusa he had seen growing beautifully at Killarney. Mr. Andrews felt convinced that to the absence of proper soil, site, and shelter, with the carelessness of gardeners not interested in such plants, those losses may be mainly attributable. Mr. Adair's objects were to stimulate a greater desire to attend to the introduction of plants from climates almost similar to our own, not with the view to general cultivation, but as ornamental to our pleasure grounds and gardens, and as improvements to cottage gardening, and which might influence the more humble classes to take interest in such pleasing and instructive amusements, and tend to divert their minds from idle pursuits.

Dr. Wright corroborated Dr. Moore's statement about the destruction of arbutus trees in the winter of 1855. Mr. Herbert had shown him great masses of the trees which had been destroyed by the frost; and this made him doubt very much whether the tree was really indigenous in Ireland. In individual instances trees can be rendered more hardy, but the exception only proves the rule. Tender plants standing in the open air usually perish in a few years. If they are covered in winter, and the air excluded, they have a much better chance of living. Hothouse plants are brought over in Ward's cases; and if these are broken, most of the plants die; but if they are covered up with snow, the wind is excluded, and they rarely suffer. He thought that hot summers tended to shorten the nodes of plants, and by checking their growth promoted their reproduction. This theory would also explain the speedy production of flowers from seedlings which had germinated in stony places.

Mr. Adair said that he used the word acclimating to include all means of naturalizing plants. Hybridization was one process of acclimation. He thought the potato was more or less a hybrid plant. He knew that in Scotland every potato of one particular kind was killed by the frost at the beginning of September, but that other kinds were uninjured. He considered a plant acclimated if it would last for twenty or thirty years. If an unusually severe frost cut it off, then he would plant fresh specimens in its place. In 1812, a vineyard planted near London yielded £500 worth of champagne, at 10*s*. per bottle. The palm tree he had alluded to as growing in the Botanic Gardens at Edinburgh was perfectly isolated. Probably Dr. Moore referred to another specimen when he spoke of it as growing against a wall; all plants, however hardy they might be, were, more or less, cut up by a severe winter. He would not be discouraged by this, but would plant fresh specimens to replace those which were destroyed. Plants would not bear more than a certain degree of heat or cold. The word climate cannot be confined to temperature, but should be employed in a more general sense, inclusive of treatment, wind, &c.

The Chairman said that it was very interesting to him to notice how greatly our gardens had improved in variety since he was a boy. All this was owing to efforts like Mr. Adair's. He thought more attention might be paid to forest trees—it would be so easy to have a succession of them. He could remember when the fuchsia was considered a sufficiently rare plant to be interesting. It was so common now that only curious varieties attracted much attention. Did Dr. Moore intend to imply that individual plants did not become more hardy, or that the race did not? Maize was now cultivated much farther north than formerly. It was noticed that when maize was sown in a cold climate, only a few seeds germinated; but the produce from these yielded a large crop next year, and so on. When wheat was brought from a hot country to a cold one, it ripened earlier for the first year or two; but the produce soon became acclimatized, and then ripened at the same time as wheat ordinarily does in the country. The importation of seeds was very valuable, and Darwin had shown that sterile plants might be fertilized with the pollen of very different species. Many buds may be removed from newly imported plants without injuring them. Animals suffered much more from sudden fluctuations of temperature than from the extremes of heat and cold, and it might be the same with plants. If plants proved likely to be easily acclimatized, it would be well to follow the example of the Adelaide Botanic Gardens mentioned by Dr. Barry. and distribute slips throughout the country, when slight variations would be more likely to occur, and give a better chance of success.

Mr. A. G. More then called the attention of the Meeting to a specimen of the rare petrel (*Pterodroma caribaea*) recently sent from Jamaica by Sir Leopold M'Clintock. This bird must not be confounded with the stormy petrel; it was more nearly allied to the shearwater. In the breeding season it burrows in the ground like a rabbit. It issues from its burrows at dusk, and flies about over the sea. But three specimens were known, all of which were in the Museum of the Royal Dublin Society. The first specimen was sent to Dr. Carte three years ago. This bird is distinguished from all other petrels by the white patch above the tail.

Mr. **More** then gave an account of his experience in shooting seals. He had succeeded in obtaining three, two of which were exhibited. Two kinds of seal were common in Ireland—the common seal (*Phoca vitulina*), of which he had obtained two specimens, and the great grey seal (*Halichærus grypus*), of which he had obtained only one. This, however, was a very fine one, weighing 3½ hundred weight, and measuring 7 feet 9 inches in length. It was a peculiarity of the fur of the seals that the animals looked white when lying on the rocks.

A collection of flint arrow heads, which had been sent to the Meeting by Mr. **Edward Hull**, F. R. G. S., Local Director of the Geological Survey, were exhibited; some of these had been collected in Antrim.

Dr. **Reynolds** exhibited specimens of lignite and other minerals from the basalt of the Giant's Causeway. He gave a description of the arrangement of the columns of the Giant's Causeway, illustrated by a photograph, the only one he was enabled to obtain, projected on the screen.

Monday, January 17, 1870.

Mr. John Adair in the Chair.

Dr. Alexander Macalister read his paper "On the Curves in the Spine, considered from an Æsthetical Point of View," illustrating his subject by diagrams on the black board.

Dr. J. Emerson Reynolds read his paper, entitled "Notes on the Determination of the 'Flashing Point' of Petroleum Oils in accordance with the terms of the Act of Parliament," which he illustrated by various interesting experiments.

Dr. De Ricci spoke of the great value of petroleum oils, their cheapness, and the importance of guarding against accidents occurring in their use. His friend, Mr. Dixon, suggested that, although the flame of the induction spark was very slight, the points of the wire might, in time, become heated, and lead to error in the results of the experiments.

Dr. Reynolds replied that on applying a thermometer to the wires no increase of heat was perceptible, and that the time of passing of the spark was inappreciable.

Mr. Howard Grubb exhibited drawings of the Nebula in η Argos—one taken by Sir John Herschel thirty-four years ago, and another taken recently by Mr. Leseur with the great Melbourne telescope.

Dr. Reynolds exhibited a new Light, recently proposed for use in Photography, by Dr. Van Monckhoven, of Vienna. He said that photographers and chemists had long been in search of a light that should be at once very powerful, and very rich in actinic rays. Dr. V. Monckhoven's light was very interesting, and therefore he had brought it forward; but he feared it could hardly be practically used in photography. Hydrogen gas was passed over chloro-chromic acid, and burnt at a jet. When oxygen gas was turned into this flame a very bright light was produced, especially if heat was applied to the acid at the same time. Chloro-chromic acid is a compound of chlorine, oxygen, and chromium; and green oxide of chromium is produced in the flame, which becomes very hot and incandescent as soon as the oxygen is turned into the flame. It would not be difficult to obtain a negative by means of this light.

MONDAY EVENING, MARCH 21, 1870.

ARTHUR WYNNE FOOT, M. D., in the Chair.

PROFESSOR HENNESSY read a paper "On the Climate of Ireland in reference to the Cultivation of Flax."

MR. J. HAYES read his paper "On Co-operative Associations in reference to the Rural Population."

DR. FOOT complimented Mr. Hayes on his paper. He thought that energy and capital were required for co-operation, and that the Irish had not energy enough to cohere sufficiently. The "Farmer's Gazette" had used every effort to improve the quality of Irish butter. Irish cheese will not sell; Howth herrings are very large, and are sent to Lough Fine to be branded as Lough Fine herrings, and sold in London.

MR. WILSON remarked that he was a landlord, and had property in three counties. A friend of his wanted to take Rostellan Castle for a dairy farm; but £20,000 or £30,000 would have been required for the purpose, and it cannot be expected that tenants should subscribe or agree to raise such a sum as that. His experience was that a tenant could not live on six acres of land, and he entirely disapproved of the system of small farms. The soil of Ireland will not produce cheese.

MR. ADAIR asserted that Irish cheese used to be good twenty years ago. Tipperary cheeses equal to Stilton were made by a Scotchman a short time ago, but his landlord turned him out for making too much profit. The co-operative system wants carrying out by sensible men in Ireland. The country had greatly improved within the last twenty or thirty years; a number of people bent upon co-operation would put everything right in Ireland.

MR. GOOD said that the secret of making butter was to equalize the quality. No two people can produce exactly similar butter. Irish butter was considered bad if the colour was different. Co-operative meetings were being held in Cheshire, but the Irish farmers would not do it. A great amount of management was required for co-operative purposes. A quarterly division would not satisfy those who were contributing milk daily. Quick returns were necessary. He then spoke of the difficulties he had found in establishing a co-operative coal and grocery store, and thought that conflicting interests would stand very much in the way of a good board of management, and that cash transactions would be indispensable.

MR. BRUNKER said that the greatest difficulty would be to get farmers to subscribe a sufficiently large capital. It would be better to dispose of butter by means of factors. As for flax, the steeping was the difficulty, as, if not carefully done, it would spoil.

DR. FOOT called on Mr. Hayes to reply.

MR. HAYES said that small farmers generally have thirty acres, and the value of their produce is very variable. Co-operation was a great advantage in Switzerland, and might be here. If it was their interest, the farmers would co-operate. Working men co-operate very successfully in England. He did not see why co-operation should not succeed in a poor country as well as in another. It was only a question of management. There was plenty of capital in the country.

DR. FOOT called attention to the objects exhibited—viz., "A Series of Studies of Ancient Ecclesiastical Edifices of Ireland," by RICHARD JOHNSON, ESQ.; and a collection of Insects from Trinidad, presented to the Society by Lieut. DE TESSIER PREVOST, 47th Regiment.

MONDAY EVENING, APRIL 18, 1870.

ROBERT S. BALL, A. M., in the Chair.

DR. JOHN BARRY read his paper "On the Australian Aborigines."

MR. F. E. DAY LEWIS read a paper "On the Cultivation and Distillation of Flowers in the South of France."

MONDAY EVENING, MAY 23, 1870.

PROF. W. T. THISTLETON DYER in the Chair.

PROF. ROBERT S. BALL, A. M., read his paper "On an Account of Experiments on the Mechanical Efficiency of the Differential Pulley-Block and Epicycloidal Pulley-Block."

DR. J. EMERSON REYNOLDS gave an account of a series of Mineralogical Tables which he has lately constructed.

MR. YEATES then called attention to his new form of thermo-electric pile. He observed that if you take a metallic conductor and hammer it, or otherwise disturb the arrangement of its particles, and then submit it to heat, an electric current is produced. A much stronger effect is produced by taking two metals of opposite electric affinities, and heating them in contact. Bismuth was positive, and antimony negative, and these were generally used soldered together for this purpose, and heated at the point of contact. As the temperature rises, the strength of the electric current increases; but a great drawback exists in the low temperature at which these metals fuse; but it had lately been discovered that galena and iron will answer equally well. Mr. Yeates's pile has 120 plates, and is heated by gas in the middle. It will decompose 25 centimetres of gas in a minute, or a large electro-magnet can be charged by it.

MR. YEATES next proceeded to call attention to a Printing Telegraph. Many kinds of printing telegraphs had been proposed, but the first was undoubtedly the best; but it was too expensive for use, as a separate wire was wanted for each letter of the alphabet. Another system, Bonelli's, was in use in some parts of Germany, which required only six wires, but it was very slow. The Needle Telegraph would give twenty words per minute, and forty-eight at its maximum. It was only used in England, but was a greater favourite there than any other. Morse's Recording Telegraph was the next favourite in England, and was almost exclusively used in America. It worked by making marks on paper. It was the next quickest in action. Brady's Alphabetical Telegraph was most used on the Continent. It spells the messages in ordinary letters, but does not record them. Mr. Yeates's was a combination of Brady's and Morse's. In Morse's Telegraph the paper i rolled out by clockwork, too quickly for convenience. Brady's Telegraph is liable to inaccuracy; if the current is too strong, letters are skipped; if the manipulator is turned the wrong way, you get the wrong letter.

DR. JACOB observed that in Wheatstone's Domestic Telegraph there was no means of the reader checking the manipulator in case of an error, without throwing the machinery out of gear. Had Mr. Yeates any means of overcoming this difficulty? He thought that Mr. Yeates's instrument was much slower than Mr. Wheatstone's, and would be useless for long messages. Had Mr. Yeates any mechanical arrangement for moving the indicator?

MR. NELSON thought that Mr. Yeates's instrument would only be found useful for printing, and that it was not quick enough for other purposes. The Needle Telegraph was two or three times as rapid, and would give 120 letters a minute. But Wheatstone's telegraph, when tested, was found to be quicker, easier, and more correct than any other. In Mr. Yeates's instrument speed was sacrificed to the printing. Persons with a little practice can read the message by the ear, and write it down as fast as it is delivered.

DR. JACOB asked if Mr. Yeates's instrument was suitable for long messages as well as short. This and Mr. Wheatstone's can be worked without any special training. If the distance at which they would work was not too short, the telegraphic system could be extended to districts where it would be too little remunerative to make it possible otherwise.

MR. WILSON said that any instrument would work equally well at any distance.

MR. YEATES confirmed this statement, and added that it was only necessary to turn the switch if a wrong message was being delivered, and it would stop at once. The Needle Telegraph would give twenty words a minute, and forty-eight at a maximum, and so would the present. Wheatstone's instrument was just the same as Brady's, except that it was worked by a voltaic pile instead of by a permanent magnet. Wheatstone's telegraph moved the index by a handle, and it required to make one-third of a revolution for each letter. It does not really work fast. This instrument can be worked much faster than was shown. Its maximum speed would be from eight to twelve words per minute. Wheatstone's instrument was hardly so quick, and was unsuitable at long distances. Electric instruments were much superior to magnetic, especially for long distances.

Dr. Reynolds then exhibited a number of sections of various crystals by means of a new polariscope, which Mr. Yeates had fitted to the magic lantern.

AFTERNOON SCIENTIFIC LECTURES.

The second series of Lectures was delivered in the Society's Lecture Theatre, as follows:—

Tuesday, March 15.—William Huggins, Esq., F. R. S.:—"On the Results of Spectrum Analysis as applied to the Heavenly Bodies."

Saturday, March 26.—Robert M'Donnell, Esq., M. D., F. R. S., Professor of Anatomy and Physiology, Steevens' Hospital Medical College, &c.:—"On Phosphorescence and Fluorescence."

Saturday, April 2.—Dr. J. Emerson Reynolds, V. P. R. G. S., Keeper of the Minerals and Analyst, Royal Dublin Society:—"On Ozone—Nature's Bleaching Agent and Disinfectant."

Saturday, April 9.—Humphrey Minchin, Esq., M. D., Professor of Botany, Royal College of Surgeons:—"On some interesting Phenomena of Sound."

Saturday, April 16.—Edward Hull, Esq., F. R. S., Director of the Geological Survey of Ireland; Professor of Geology, Royal College of Science:—"On the Extension of the Coalfields of England under the newer Formations."

Saturday, April 30.—Wyville Thomson, Esq., LL. D., F. R. S., Professor of Natural History, Queen's College, Belfast:—"On the Cruise of the 'Porcupine.'"

Saturday, May 7.—H. N. Draper, Esq., F. C. S.:—"On Colours from Coal Tar."

Saturday, May 14.—Charles R. C. Tichborne, Esq., F. C. S., Chemist to the Apothecaries' Hall, Ireland:—"On Atmospheric Dust."

The Lectures were attended in the aggregate by 2289 persons, averaging 286 at each Lecture.

ANNUAL SPRING CATTLE SHOW.

This great Exhibition was held on the Society's premises on the 20th, 21st, and 22nd of April, 1870, when the following Stock, Poultry, and Implements were shown:—

Short-horned Bulls,	168	Fat Sheep (lots),	10
" Cows and Heifers,	20	Swine (lots),	49
Other Breeds, Bulls,	18	Poultry (lots),	279
" Cows and Heifers,	39	Implements (lots),	90
Fat Kine,	76		

Instead of the Meeting held in the evening of the second day of the Show for announcing the Prizes won at the Show, the Society dined together at the Exhibition Palace. During the dinner the performance of a selection of vocal quartettes contributed much to the gratification of all present.

CONVERSAZIONE.

On the evening of the 1st of March, the Society held a Science and Art Conversazione, which was honoured by the presence of their Excellencies the Lord Lieutenant and the Countess Spencer, and a large assemblage of guests and members of the Society.

In the Library was displayed a large collection of objects of Art and Virtu, including Studies from Nature and Art Studies, by Mr. C. B. Watkins, Mr. Richard Johnston, Mr. Aitken, and Mr. M'Donnell, and by Students in the School of Art; Photographs and Photo-lithographs, by Mr. Grubb, C. E., Mr. Brownrigg, Messrs. Millard and Robinson, and Mr. Chancellor; a splendid Heraldic Work, executed on vellum, by Mrs. J. R. D'Olier, bound in covers of oak, elaborately carved from designs by Mrs. D'Olier; a Chinese Silver Tea Service, lent by Lord Gough; Leaves from King Theodore's Bible, illuminated, by Dr. Barker; and the "All Ireland" Challenge Shield. In the Reading Room adjoining the Library were a large number of Microscopes, and Microscopic Ojects were exhibited by Drs. Traquaire, Macalister, Steele, J. Barker, Mapother, Carte, Moore, Reynolds, Rev. Eugene O'Meara, Messrs. Archer, Porte, A. Andrews, Vereker, Yeates, Spencer, &c.

IN THE LECTURE THEATRE

Mr. Simonton exhibited a series of Photographic Transparencies and Dissolving Views of Irish, English, Scottish, German, French, Swiss, and Italian Scenery; a pair of powerful Lanterns was used to project the Views on to a large screen, and to show a fine photograph of the Moon, taken with the Great Melbourne Telescope.

Mr. J. V. Robinson exhibited, with the aid of the Lime Light, the gradual development of the latent image on a Photographic Film.

Mr. Yeates showed some remarkable effects, obtained by passing Polarized Light through Crystals and Minerals, and through plates of unannealed Glass.

Mr. Yeates also exhibited some striking Electrical Experiments with Vacuum Tubes and Gassiot's Cascade.

A fine series of Views of the Opening of the Suez Canal, of Egypt, and Eastern Scenery, of Rome, and of Pompeii, was shown by Mr. Simonton on a very large scale. Photographs of Statuary, taken from the best specimens of Ancient and Modern Art, were likewise exhibited at the close of the evening.

IN THE UPPER HALL OF THE MUSEUM,

On the gallery, a Lighthouse was fitted with the great Annular Lens, used for Revolving Lights; this structure likewise carried a segment of the Cylindric Refracting Belt employed for Beacons with fixed lights—both being exhibited with the permission of the Commissioners of Irish Lights. By Mr. J. A. Wigham.

THE FOLLOWING OBJECTS WERE ALSO EXHIBITED.

Electric Light shown with large Lens on Gallery. By Mr. Yeates.

A Sectional Model of a Locomotive, and Specimens of Iron and Steel; Steel Turnings of great length. By Mr. A. M'Donnell, C. E.

An Electro-motor Engine. By Dr. Cruise.

A large Model Locomotive, and a Case of Scientific Instruments. By Messrs. Spencer and Son.

A Model showing proposed Alteration in Carlisle Bridge. By Mr. Charles Geoghegan, C. E.

A Series of Rare Chemicals, and Materia Medica Specimens. By Mr. Tichborne, F. C. S.

A Model Petroleum Stove, Graphoscopes, Stereoscopes, Printing Presses, Model Engines, Steamers, &c. By Mr. James Robinson.

A Patent Fret Sawing Machine in operation, and a Collection of Tools employed in Fret Cutting and Carving, and Specimens of Work. By Messrs Booth, Brothers.

Specimens of Epicycloidal Turning. By Mr. W. B. Blood.

Fine Specimens of Hammered Iron Work. By Mr. Fagan.

An Electric Clock in action. By Mr. J. R. Wigham.

Model of "Domestic Gas Apparatus." By Messrs. Edmundson and Co.

A small Primary Electric Clock in action. By Mr. J. H. Lyddon.

A Model of the Great Melbourne Telescope. By Mr. Grubb, C. E.

Large Compound Microscope, and Gyroscopes, Polariscopes, &c. By Messrs. Mason and Son.

Specimens exhibiting the Solvent Power of the Liquor and other Preparations of Pepsine. Some Pharmaceutical Products. By Messrs. Hamilton, Long, and Co.

Graphoscopes, Stereoscopes, &c., and Musical Boxes of various kinds, and *Objets d'Art*. By Mr. Simonton.

The Magic Bouquet. By Mr. Yeates.

IN THE LOWER HALL OF MUSEUM

Refreshments were provided.

The Band of the 43rd Regiment performed during the evening.

FEBRUARY, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN. IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Monday, . . .	20	28·792	46	28·748	48	45	41	42	43	48	47	N. W.	1	·030	Fine, breezy, changeable, occas. sunshine.
2 Tuesday, . . .	21	29·632	42	29·596	46	35	32	40	42	46	45	S. W.	3	. .	Fine, mild, bright, sunshiny day.
3 Wednesday, .	22	29·580	52	29·518	54	40	35	43	43	54	53	S. W.	1	·060	Fine, mild, changeable, occasional sunsh.
4 Thursday, . .	23	29·860	53	29·798	55	51	47	45	45	55	53	S. W.	0	. .	Fine, breezy, mild, changeable day.
5 Friday, . . .	24	29·958	54	29·891	56	50	46	46	47	55	54	S. W.	0	. .	Fine, mild, cloudy, changeable day.
6 Saturday, . .	25	29·892	53	29·830	56	51	46	46	47	56	54	S. W.	0	. .	Do.
7 Sunday, . . .	26	29·580	52	29·518	54	46	42	46	47	55	53	S. W.	1	·040	Strong, breezy, showery, occas. sunshine.
8 Monday, . . .	27	29·132	54	29·066	56	46	47	47	48	55	54	S. W.	1	·240	Do.
9 Tuesday, . . .	28	29·594	45	29·553	46	41	38	44	46	46	45	S. W.	1	·250	Do.
10 Wednesday, .	29	29·684	51	29·627	53	46	42	45	46	52	51	W.	0	·040	Breezy, cloudy, changeable day.
11 Thursday, . .	●	29·982	47	29·936	50	45	42	44	46	49	48	W.	2	·100	Fine, mild, changeable, occas. sunshine.
12 Friday, . . .	1	29·778	39	30·758	43	37	34	41	44	44	42	N. W.	1	. .	Fine, mild, cloudy, changeable, occa. sunsh.
13 Saturday, . .	2	30·260	43	30·224	46	35	31	39	42	46	44	S. W.	3	·070	Fine, cold, changeable, occas. sunshine.
14 Sunday, . . .	3	30·082	50	30·024	52	44	41	42	43	51	50	S. W.	0	. .	Strong, breezy, cloudy, changeable day.
15 Monday, . . .	4	30·156	48	30·114	50	47	43	44	45	50	48	S. W.	0	. .	Fine, mild, cloudy, changeable day.
16 Tuesday, . .	5	29·614	52	29·552	54	46	44	44	45	54	52	S. W.	0	. .	Fine, breezy, cloudy, changeable day.
17 Wednesday, .	6	29·444	50	29·388	52	41	37	44	45	52	49	S. W.	4	·050	Fine, breezy, bright sunshine.
18 Thursday, . .	7	29·580	46	29·534	49	35	31	41	44	49	47	S. W.	4	. .	Fine, mild, bright sunshine.
19 Friday, . . .	8	29·972	44	29·931	48	34	31	39	42	48	46	N. W.	3	. .	Fine, breezy, changeable, occas. sunshine.
20 Saturday, . .	9	29·744	47	29·698	49	43	40	41	43	49	48	S. W.	0	·020	Cloudy, mild, showery, changeable day.
21 Sunday, . . .	10	29·972	46	29·926	48	43	39	42	44	47	46	N. E.	0	. .	Fine, mild, cloudy, changeable day.
22 Monday, . . .	11	30·022	44	29·980	47	42	39	42	44	46	45	S. W.	0	·060	Do.
23 Tuesday, . . .	12	30·176	44	30·140	47	33	30	40	43	48	46	S. W.	2	·060	Fine, breezy, changeable, occas. sunshine.
24 Wednesday, .	13	29·588	48	29·536	50	45	41	42	44	49	48	S E.	0	·050	Strong breeze, showery, changeable day.
25 Thursday, . .	14	29·588	48	29·536	50	36	33	40	42	51	50	S. W.	0	·120	Do.
26 Friday, . . .	15	30·086	47	30·039	57	41	39	42	44	51	48	N. W.		. .	Fine, breezy, bright, sunshine.
27 Saturday, . .	16	30·086	44	30·044	47	40	37	42	44	45	42	N. W.	4	.	Do.
28 Sunday, . . .	17	29·814	37	29·794	39	33	30	37	40	39	38	S. W.	0	·110	Strong, breezy, cold, showers, snow.
													34	1·300	inches.

MARCH, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
1 Monday, . .	18	29·700	42°	29·664	44°	39°	35°	39°	41°	44°	48°	S. W.	0	·040	Fine, mild, cloudy, changeable day.
2 Tuesday, . .	19	29·300	42	29·268	47	36	33	39	41	46	44	S. W.	3	·320	Fine, breezy, cold, bright, sunshine.
3 Wednesday, .	20	30·020	36	30·000	38	32	29	36	39	38	37	S. E.	0	·080	Cloudy, showery, cold, changeable day.
4 Thursday, . .	21	30·150	42	30·114	46	35	31	38	40	46	44	N. W.	3	·020	Fine, mild, changeable, occasional sunshine.
5 Friday, . . .	22	30·020	47	29·973	50	46	41	42	43	49	46	N. W.	2	. .	Fine, breezy, changeable, occasional sunsh.
6 Saturday, . .	23	30·280	44	30·238	49	36	29	39	42	49	47	N. E.	3	. .	Fine, mild, changeable, occasional sunshine.
7 Sunday, . .	24	29·980	42	29·944	45	38	33	39	41	45	44	E.	0	·150	Cloudy, wet, changeable day.
8 Monday, . .	25	29·934	44	29·898	46	40	36	40	42	46	44	N. W.	3	. .	Fine, breezy, changeable, occasional sunshine.
9 Tuesday, . .	26	29·562	37	29·542	41	31	27	37	40	39	41	N. E.	1	. .	Fine, breezy, cold, changeable.
10 Wednesday, .	27	29·490	35	29·476	38	29	26	35	38	38	37	N. E.	0	·260	Cloudy, cold, changeable, showers of hail.
11 Thursday, . .	28	29·650	39	29·625	42	31	29	35	38	42	40	N. W.	4	·180	Fine, breezy, cold, bright sunshine.
12 Friday, . . .	29	29·612	35	29·597	39	28	27	34	37	38	36	S. E.	0	. .	Cloudy, changeable, like rain.
13 Saturday, .	●	29·600	38	29·575	40	36	33	36	38	39	37	N. E.	1	·050	Cold, breezy, changeable.
14 Sunday, . .	1	29·882	38	29·556	47	34	30	36	38	41	39	N. E.	1	·070	Breezy, changeable, showers of hail.
15 Monday, . .	2	29·772	41	29·742	44	32	29	36	38	44	41	S. E.	4	·050	Fine, breezy, bright sunshine.
16 Tuesday, . .	3	29·544	45	29·503	49	37	32	37	39	49	47	S. E.	1	. .	Fine, breezy, cloudy, changeable.
17 Wednesday, .	4	29·212	45	29·172	47	40	37	39	40	46	45	N. E.	0	·250	Cloudy, mild, showery, changeable.
18 Thursday, . .	5	29·756	47	29·716	48	39	34	40	41	47	46	S. W.	2	·030	Breezy, showery, changeable, occas. sunsh.
19 Friday, . . .	6	29·418	39	29·393	37	36	31	38	40	36	36	N. E.	0	·700	Breezy, wet, changeable, showers of snow.
20 Saturday, . .	7	29·816	43	29·780	46	34	30	37	39	45	43	N. W.	4	·140	Fine, breezy, bright, sunshine.
21 Sunday, . . .	8	30·068	47	30·021	49	38	34	38	40	48	46	N. E.	5	. .	Fine, breezy, changeable, occasional sunsh.
22 Monday, . .	9	30·264	43	30·228	47	35	31	38	40	47	44	N. E.	3	. .	Do.
23 Tuesday, . .	10	30·378	45	30·336	48	32	29	39	41	48	46	N. E.	4	. .	Do.
24 Wednesday, .	11	30·264	44	30·222	48	33	29	39	41	48	47	N. E.	0	. .	Cloudy, cold, changeable day.
25 Thursday, . .	12	30·172	43	30·136	47	31	28	38	40	47	45	N. E.	0	. .	Cloudy, mild, changeable day.
26 Friday, . . .	13	30·042	45	30·000	48	37	33	39	41	47	44	N. W.	3	. .	Breezy, changeable, occasional sunshine.
27 Saturday, . .	14	29·832	41	29·802	44	38	30	37	40	44	41	N. W.	2	. .	Breezy, cold, changeable, occasional sunsh.
28 Sunday, . . .	15	29·832	44	29·791	46	36	32	38	40	47	42	N. E.	3	. .	Fine, breezy, changeable, occasional sunsh.
29 Monday, . .	16	30·022	43	29·986	45	39	34	39	41	45	42	N. E.	1	. .	Do.
30 Tuesday, .	17	30·058	41	30·027	42	39	36	38	40	42	40	N. E.	0	. .	Fine, breezy, cloudy, cold day.
31 Wednesday, .	18	30·000	45	29·958	48	37	32	39	41	48	46	N. E.	3	. .	Fine, breezy, bright sunshine.
													56	2·200	Inches.

APRIL, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P.M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth.		Dry.	Wet.	Direction.			
								5 in.	10 in.						
			°		°	°	°	°	°	°	°				
1 Thursday, . .	19	29·942	43	29·906	48	35	31	39	41	48	46	S. W.	0	. .	Cloudy, mild, and changeable day.
2 Friday,. . . .	20	29·472	49	29·421	51	43	39	42	43	51	49	S. W.	2	·160	Breezy, showery, changeable, occas. sunsh.
3 Saturday,. . .	21	29·472	41	29·442	44	35	32	38	41	43	41	N. W.	2	·170	Breezy, showers of hail, changeable.
4 Sunday, . . .	22	29·800	44	29·759	47	35	32	38	40	46	44	N. W.	2	. .	Fine, breezy, changeable, occasional sunsh.
5 Monday, . . .	23	29·978	48	29·926	50	42	39	41	42	49	47	S. W.	0	. .	Fine, breezy, cloudy, changeable day.
6 Tuesday, . . .	24	29·678	50	29·621	58	44	41	44	44	57	56	S. W.	0	·070	Do.
7 Wednesday, .	25	29·822	43	29·786	44	43	41	44	45	43	43	N. E.	0	·150	Cloudy, wet, changeable day.
8 Thursday, . .	26	29·980	43	29·944	46	40	37	43	44	46	45	N. E.	0	·060	Showery, mild, changeable day.
9 Friday,. . . .	27	29·950	46	29·904	48	42	39	42	43	47	47	S. E.	0	·320	Cloudy, wet, cold, changeable day.
10 Saturday, . .	28	29·950	53	29·888	57	37	33	48	45	57	55	N. E.	4	·180	Fine, mild, changeable, occasional sunsh.
11 Sunday, . . .	29	30·000	64	29·905	67	48	42	48	48	66	62	S. E.	5	. .	Fine, mild, warm, bright sunshine.
12 Monday, . . .	●	30·114	63	30·024	64	47	43	48	48	62	60	S. E.	5	. .	Do.
13 Tuesday, . . .	1	30·044	59	29·965	60	44	40	50	50	64	62	S. E.	6	. .	Fine, breezy, bright sunshine.
14 Wednesday, .	2	29·888	54	29·821	57	45	42	48	49	56	54	N. W.	0	. .	Fine, mild, cloudy, changeable.
15 Thursday, . .	3	29·478	50	29·422	51	42	38	46	48	51	49	S. E.	1	·030	Fine, breezy, showery, changeable day.
16 Friday, . . .	4	29·266	50	29·210	53	46	42	46	48	53	57	N. W.	0	·220	Breezy, cloudy, showery, changeable day.
17 Saturday, . .	5	29·642	50	29·585	52	44	41	45	49	52	50	N. E.	2	·100	Do.
18 Sunday, . . .	6	30·132	51	30·074	54	38	35	44	46	58	57	N. E.	4	. .	Fine, breezy, changeable, occasional sunsh.
19 Monday, . . .	7	29·900	51	29·843	54	40	38	44	46	53	52	S. W.	0	·090	Cloudy, wet, mild, changeable day.
20 Tuesday, . . .	8	29·572	55	29·605	58	45	41	46	48	52	51	S. W.	2	·100	Breezy, showery, changeable.
21 Wednesday, . .	9	29·928	57	29·855	60	44	40	46	48	60	57	S. W.	5	·120	Fine, mild, changeable, occasional sunsh.
22 Thursday, . .	10	29·766	49	29·714	51	47	43	46	48	50	49	S. E.	0	. .	Breezy, cloudy, changeable, like rain.
23 Friday,. . . .	11	30·068	54	30·000	58	37	35	46	48	57	55	S. E.	5	. .	Fine, mild, changeable, occasional sunsh.
24 Saturday,. . .	12	30·000	52	29·964	55	44	40	46	48	54	52	S. W.	0	. .	Showery, mild, changeable.
25 Sunday, . . .	13	30·260	57	30·213	60	46	42	48	48	59	58	S. E.	4	.030	Fine, breezy, bright sunshine.
26 Monday, . . .	14	30·222	59	30·143	61	45	41	49	51	61	59	S. E.	6	. .	Do.
27 Tuesday, . . .	15	30·272	59	30·193	60	42	40	50	51	60	57	N. E.	6	. .	Fine, mild, warm, bright sunshine.
28 Wednesday, .	16	30·310	56	30·236	57	47	42	50	51	57	55	N. E.	6	. .	Fine, breezy, bright sunshine.
29 Thursday, . .	17	30·310	51	30·252	53	43	40	49	50	52	50	N. E.	6	. .	Do.
30 Friday, . . .	18	30·172	55	30·104	56	42	39	48	50	56	54	S. E.	7	. .	Do.
													80	1·800	inches.

MAY, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Saturday, . . .	19	30·118	56	30·071	57	37	36	48	50	57	55	S. E.	7	. .	Fine, mild, bright, sunshine.
2 Sunday, . . .	20	29·978	51	29·921	52	48	46	47	50	52	51	S. E.	0	. .	Cloudy, mild, showery, changeable day.
3 Monday, . . .	21	29·776	48	29·724	50	45	43	47	49	50	49	S. E.	0	·300	Breezy, wet, changeable day.
4 Tuesday, . . .	22	29·818	44	29·777	46	43	43	45	48	45	44	N. E.	0	·980	Breezy, cloudy, cold, changeable day.
5 Wednesday, . .	23	29·778	44	29·737	46	43	42	44	46	46	45	S. E.	0	·100	Do.
6 Thursday, . . .	24	29·162	47	29·117	49	46	43	45	47	48	49	N. E.	0	140	Cloudy, showery, mild, changeable day.
7 Friday, . . .	25	29·082	45	29·042	47	43	41	44	46	46	45	N. E.	0	·890	Breezy, cloudy, cold, changeable day.
8 Saturday, . .	26	29·468	43	29·433	45	42	40	43	45	45	43	N. E.	0	·280	Do.
9 Sunday, . . .	27	29·632	48	29·580	48	40	37	44	46	48	47	S. E.	1	. .	Cold, cloudy, changeable, rain-like day.
10 Monday, . . .	28	29·490	50	29·434	58	47	43	46	47	51	50	N. W.	0	·040	Cloudy, mild, changeable day.
11 Tuesday, . . .	●	29·838	50	29·781	52	34	32	44	46	51	49	N. W.	4	. .	Fine, breezy, changeable, occas. sunsh.
12 Wednesday, . .	1	30·108	49	30·056	52	34	33	43	46	51	50	W.	4	. .	Do.
13 Thursday, . . .	2	30·272	52	30·209	53	34	32	44	46	53	50	N. E.	6	. .	Fine, breezy, bright sunshine.
14 Friday, ...	3	30·100	50	30·042	51	44	39	45	47	51	49	N. E.	0	. .	Cloudy, breezy, changeable day.
15 Saturday, . . .	4	29·850	51	29·793	52	46	44	46	49	52	50	N. E.	0	. .	Do.
16 Sunday, . . .	5	29·700	48	29·648	50	46	44	46	48	50	49	S. E.	0	·160	Cloudy, wet, changeable day.
17 Monday, . . .	6	29·480	51	29·424	54	46	45	49	48	54	53	S. E.	0	·150	Showery, cloudy, changeable day.
18 Tuesday, . . .	7	29·388	47	29·343	49	43	40	47	49	48	47	N. E.	0	·100	Cloudy, breezy, changeable day.
19 Wednesday, . .	8	29·528	48	29·476	52	41	39	45	48	51	49	N. E.	1	·600	Showery, breezy, cloudy, changeable day.
20 Thursday, . . .	9	29·692	51	29·635	53	36	33	44	47	51	49	N. E.	4	·020	Breezy, showery, occasional sunshine.
21 Friday, . . .	10	29·656	50	29·599	53	40	38	45	47	53	51	S. W.	0	·030	Showery, mild, changeable day.
22 Saturday, . . .	11	30·000	52	29·964	55	38	35	46	48	54	52	N. W.	8	. .	Fine, mild, changeable, occas. sunshine.
23 Sunday, . . .	12	30·020	52	29·984	53	41	36	46	48	52	51	S. E.	8	. .	Fine, breezy, changeable, occas. sunshine.
24 Monday, . . .	13	29·842	54	29·775	56	46	41	49	51	56	54	S. E.	2	·050	Do.
25 Tuesday, . . .	14	29·710	50	29·653	52	49	46	48	50	51	50	N. E.	0	·830	Cloudy, wet, changeable day.
26 Wednesday, . .	15	29·572	47	29·526	48	47	47	47	49	47	47	N. E.	0	·800	Strong, breezy, cold, wet day.
27 Thursday, . .	16	29·824	46	29·778	48	45	43	46	47	47	47	N. E.	0	·580	Breezy, showery, changeable day.
28 Friday, ...	17	30·100	48	30·048	50	44	40	46	48	50	48	N. E.	4	·050	Fine, breezy, changeable, occas. sunsh.
29 Saturday, . . .	18	30·250	57	30·208	59	37	34	47	49	59	55	N. E.	7	. .	Fine, breezy, bright sunshine.
30 Sunday, . . .	19	30·176	54	30·106	56	45	42	48	50	56	54	N. W.	2	. .	Fine, breezy, changeable, occas. sunsh.
31 Monday, . . .	20	30·178	53	30·105	57	47	44	48	50	56	54	N. W.	0	·050	Showery, cloudy, changeable day.
													48	5·100	Inches

JUNE, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Tuesday, . .	21	30·192	56	30·156	59	49	45	49	51	58	56	E.	0	. .	Cloudy, mild, changeable day.
2 Wednesday, .	22	30·038	56	29·964	58	51	48	50	52	57	56	S. E.	0	·100	Showery, mild, changeable day.
3 Thursday, . .	23	30·010	56	29·936	59	45	42	50	52	59	56	S. W.	3	. .	Breezy, changeable, occasional sunshine.
4 Friday, . . .	24	29·840	57	29·767	60	49	46	50	52	60	57	S. W.	3	. .	Do.
5 Saturday, . .	25	29·936	63	29·848	65	53	49	53	54	65	62	S. W.	0	·120	Breezy, showery, changeable day.
6 Sunday, . . .	26	30·168	60	30·083	64	54	50	54	55	64	62	S. E.	0	. .	Fine, mild, cloudy, changeable day.
7 Monday, . . .	27	30·124	63	30·034	66	56	52	55	56	64	61	S. W.	1	. .	Fine, mild, changeable, occasional sunshine.
8 Tuesday, . . .	28	30·288	60	30·203	64	51	47	55	57	63	59	N. W.	6	. .	Fine, breezy, bright, sunshiny day.
9 Wednesday, .	●	30·212	59	30·138	62	40	39	53	57	62	58	N. W.	6	. .	Do.
10 Thursday, . .	1	30·212	58	30·133	60	42	38	53	57	60	56	N. E.	4	. .	Fine, changeable, occasional sunshine.
11 Friday, . . .	2	30·138	55	30·070	56	39	36	51	54	56	53	N. W.	4	. .	Do.
12 Saturday, . .	3	29·764	57	29·691	61	41	37	52	54	60	57	S. W.	1	. .	Breezy, cloudy, changeable day.
13 Sunday, . . .	4	29·492	51	29·436	52	50	46	51	54	51	50	N. E.	0	·080	Showery, mild, cloudy, changeable day.
14 Monday, . . .	5	29·574	54	29·507	58	35	32	49	52	57	53	N. W.	5	·020	Fine, breezy, changeable, occasional sunshine
15 Tuesday, . . .	6	29·710	52	29·648	54	46	44	49	52	54	50	N. W.	5	·040	Strong breeze, showery, changeable day.
16 Wednesday, .	7	30·206	55	30·138	59	40	36	48	51	59	55	N. W.	6	·090	Showery, breezy, changeable, occas. sunsh.
17 Thursday, . .	8	30·146	54	30·078	56	47	43	50	52	55	54	S. E.	0	·030	Showery, mild, changeable day.
18 Friday, . . .	9	30·092	54	30·024	57	49	45	51	53	57	55	N. W.	0	·050	Cloudy, showery, changeable day.
19 Saturday, . .	10	29·988	55	29·921	57	53	49	51	53	56	55	N. W.	0	·030	Do.
20 Sunday, . . .	11	30·100	58	30·021	61	49	45	53	54	61	58	N. E.	2	. .	Breezy, changeable, occasional sunshine.
21 Monday, . . .	12	30·050	58	29·971	60	49	44	53	55	60	57	N. W.	1	.	Cloudy, mild, changeable, occas. sunshine.
22 Tuesday, . .	13	30·242	56	30·168	58	51	48	58	55	57	56	N. W.	0	·040	Breezy, cloudy, changeable day.
23 Wednesday, .	14	30·288	58	30·209	62	51	49	52	54	62	58	N. W.	2	. .	Breezy, changeable, occasional sunshine.
24 Thursday, . .	15	30·208	66	30·107	67	55	50	56	57	66	63	S. E.	0	. .	Fine, mild, cloudy, changeable day.
25 Friday, . . .	16	30·162	64	30·067	67	57	53	57	58	67	63	S. E.	0	. .	Do.
26 Saturday, . .	17	30·162	69	30·065	70	52	48	59	59	69	66	S. E.	0	. .	Do.
27 Sunday. . . .	18	30·298	68	30·192	70	51	48	58	60	69	65	N. E.	6	. .	Fine, breezy, bright sunshine day.
28 Monday, . .	19	30·320	68	30·214	70	46	42	58	60	69	65	N. E.	7	. .	Fine, mild, bright sunshine day.
29 Tuesday, . .	20	30·288	68	30·182	69	46	42	58	60	68	64	N. E.	7	. .	Fine, breezy, bright sunshiny day.
30 Wednesday, .	21	30·288	69	30·182	71	47	44	59	61	71	67	N. E.	8	. .	Do.
													77	·600	inches.

JULY, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Thursday, . .	22	30·250	69	30·144	70	46	42	59	60	69	66	S. E.	8	. .	Fine, breezy, bright day.
2 Friday, . . .	23	30·146	69	30·040	71	47	43	59	61	71	68	S. E.	8	. .	Do.
3 Saturday, . .	24	30·150	71	30·039	73	48	45	59	61	73	68	S. E.	7	. .	Do.
4 Sunday, . . .	25	29·994	67	29·895	69	52	48	60	61	68	67	S. E.	2	. .	Breezy, changeable, occasional sunshine.
5 Monday, . . .	26	29·728	66	29·629	69	58	52	60	61	68	65	S. W.	1	·100	Breezy, showery, changeable day.
6 Tuesday, . . .	27	29·836	66	29·737	68	58	53	59	60	67	65	N. W.	2	·140	Breezy, changeable, occasional sunshine.
7 Wednesday, . .	28	29·888	71	29·779	74	61	58	61	62	74	70	N. W.	1	. .	Do.
8 Thursday, . .	29	29·746	67	29·647	69	62	56	61	62	69	65	S. W.	1	. .	Do.
9 Friday, . . .	●	30·158	65	30·068	66	52	49	58	60	66	62	S. W.	8	. .	Do.
10 Saturday, . .	1	30·372	65	30·277	68	52	49	59	60	67	64	N. W.	8	. .	Do.
11 Sunday, . . .	2	30·206	67	30·105	68	52	47	58	60	68	64	S. E.	8	. .	Fine, breezy, bright sunshiny day.
12 Monday, . . .	3	30·134	62	30 044	65	58	54	59	61	64	62	N. W.	2	. .	Fine, breezy, changeable occasional sunshine.
13 Tuesday, . . .	4	30·258	61	30·173	64	45	42	57	60	63	60	N. W.	2	. .	Do.
14 Wednesday, .	5	30·288	66	30·187	69	52	48	58	60	68	65	S. W.	1	. .	Strong, breezy, cloudy, changeable day.
15 Thursday, . .	6	30·288	68	30·182	71	60	56	61	62	70	68	N. W.	0	. .	Cloudy, breezy, changeable day.
16 Friday, . . .	7	30·240	74	30·118	76	64	60	65	65	75	72	S. E.	5	. .	Fine, breezy, bright sunshiny day.
17 Saturday, . .	8	30·072	75	29·950	76	57	53	65	66	75	73	S. E.	8	. .	Fine, mild, bright, sunshiny day.
18 Sunday, . . .	9	30·050	72	29·931	74	59	55	65	66	73	70	N. E.	5	. .	Fiue, breezy, changeable, occasional sun.
19 Monday, . . .	10	30·144	68	30·038	71	52	48	63	65	70	67	S. E.	7	. .	Do.
20 Tuesday, . . .	11	30·122	70	30·011	71	51	48	63	65	70	66	S. E.	7	. .	Do.
21 Wednesday, . .	12	29·956	74	29·834	75	56	51	65	66	75	72	S. E.	6	. .	Fine, breezy, warm, bright sunshine.
22 Thursday, . .	13	29·850	70	29·741	71	56	53	64	65	69	66	S. W.	1	. .	Breezy, cloudy, changeable day.
23 Friday, . . .	14	29·968	71	29·859	74	53	49	63	65	74	69	S. W.	6	. .	Fine, breezy, bright day.
24 Saturday, . .	15	29·938	68	29·834	71	53	49	62	64	70	66	S. W.	4	·080	Fine, breezy, changeable, occasional sunshine
25 Sunday, . . .	16	29·788	65	29·694	67	53	51	61	64	67	65	S. W.	0	·070	Fine, mild, changeable, rain-like day.
26 Monday, . . .	17	29·610	65	29·516	66	53	51	61	62	66	64	S. W.	1	·080	Fine, breezy, changeable, occas. sunshine.
27 Tuesday, . . .	18	29·856	68	29·768	65	50	46	59	61	64	61	S. W.	4	. .	Do.
28 Wednesday, . .	19	29·920	65	29·826	66	53	49	60	61	65	62	W.	8	·040	Showery, changeable, occasional sunshine.
29 Thursday, . .	20	29·640	59	29·562	60	47	42	57	59	59	58	S. E.	0	·050	Showery, changeable, strong gale.
30 Friday, . . .	21	29·800	62	29·712	63	55	51	57	59	63	61	S. W.	0	·070	Showery, mild, cloudy, changeable day.
31 Saturday, . .	22	29·878	64	29·784	66	57	52	59	61	66	62	S. W.	2	·070	Breezy, cloudy, changeable, occasional sun
													108	·700	Inches.

AUGUST, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In earth. 5 in.	In earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Sunday, . . .	23	29·644	60	29·561	60	52	47	56	59	58	57	S. W.	2	·110	Breezy, showery, changeable, occas. suns.
2 Monday, . . .	24	29·826	57	29·753	58	50	48	55	58	58	56	N. W.	3	·160	Do.
3 Tuesday, . . .	25	29·644	61	29·561	63	49	44	56	58	62	61	N. W.	0	·100	Showery, mild, cloudy, changeable day.
4 Wednesday, . .	26	29·884	64	29·790	67	55	51	58	60	66	64	S. E.	0	·060	Cloudy, mild, changeable day.
5 Thursday, . . .	27	30·232	61	30·147	63	48	43	56	58	62	60	N. W.	4	·070	Breezy, changeable, occasional sunshine.
6 Friday, ...	28	30·350	68	30·260	66	47	42	56	58	65	61	N. W.	5	. .	Fine, mild, bright day.
7 Saturday, . . .	●	30·100	63	30·010	64	46	41	56	58	63	61	S. W.	1	. .	Breezy, cloudy, changeable, occas. sunsh.
8 Sunday, . . .	1	29·846	62	29·758	65	57	53	57	59	65	63	S. W.	1	·060	Do.
9 Monday, . . .	2	29·628	64	29·534	64	58	54	58	59	63	61	N. W.	2	·050	Do.
10 Tuesday, . . .	3	29·892	58	29·814	60	48	44	55	57	59	56	N. W.	2	·020	Breezy, showery, changeable, occas. suns.
11 Wednesday, . .	4	30·026	61	29·941	68	51	48	55	57	63	59	N. W.	4	. .	Fine, breezy, changeable, occasion. sunsh.
12 Thursday, . . .	5	30·000	65	29·905	67	48	44	55	57	67	63	S. E.	6	. .	Fine, breezy, bright day.
13 Friday, ...	6	29·896	59	29·818	61	56	51	56	59	61	59	N. W.	0	·110	Breezy, cloudy, changeable day.
14 Saturday, . . .	7	30·192	62	30·102	65	51	47	56	59	64	61	N. W.	4	·060	Fine, breezy, changeable, occas. sunshine.
15 Sunday, . . .	8	30·298	65	30·208	69	55	51	58	59	68	65	S. W.	2	. .	Do.
16 Monday, . . .	9	30·338	64	30·243	67	53	49	58	60	66	63	N. W.	4	·020	Do.
17 Tuesday, . . .	10	30·432	62	30·342	66	48	44	58	60	65	64	N. E.	1	. .	Fine, mild, cloudy, changeable day.
18 Wednesday, . .	11	30·364	62	30·274	65	41	38	56	59	65	62	S. E.	2	. .	Breezy, foggy, changeable, occas. sunsh.
19 Thursday, . . .	12	30·326	64	30·231	66	53	49	58	60	65	62	S. E.	1	. .	Breezy, cloudy, changeable, occas. sunsh.
20 Friday, ...	13	30·326	69	30·220	70	51	47	59	61	69	66	S. E.	2	. .	Do.
21 Saturday, . . .	14	30·340	64	30·245	67	49	46	58	60	66	63	N. W.	0	. .	Fine, cloudy, mild, changeable day.
22 Sunday, . . .	15	30·328	68	30·222	70	49	45	58	60	68	66	S. E.	5	. .	Fine, breezy, bright day.
23 Monday, . . .	16	30·176	67	30·075	69	49	46	58	60	68	65	S. W.	3	. .	Fine, breezy, changeable, occas. sunshine.
24 Tuesday, . . .	17	30·176	72	30·059	75	61	58	62	63	75	71	N. W.	5	. .	Fine, breezy, warm, bright day.
25 Wednesday, . .	18	30·220	71	30·109	71	53	49	62	63	70	68	S. E.	6	. .	Do.
26 Thursday, . . .	19	30·290	75	30·168	78	48	44	62	63	78	73	S. E.	6	. .	Fine, mild, warm, bright day.
27 Friday, ...	20	30·300	72	30·183	75	50	46	63	64	75	71	S. E.	6	. .	Do.
28 Saturday, . . .	21	30·100	78	29·967	81	54	50	64	65	81	76	S. E.	6	. .	Do.
29 Sunday, . . .	22	30·156	54	30·088	54	53	51	59	62	53	52	N. E.	0	. .	Breezy, cloudy, like rain.
30 Monday, . . .	23	30·350	58	30·271	59	49	44	57	59	59	56	N. E.	5	·270	Fine, breezy, bright day.
31 Tuesday, . . .	24	30·406	55	30·338	58	39	35	54	57	58	55	N. E.	0	. .	Breezy, cloudy, changeable, fine day.
													88	1·090	inches.

SEPTEMBER, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Wednesday, . . .	25	30·450	59	30·371	61	50	47	55	57	61	59	N. E.	2	. .	Fine, breezy, changeable, occasional sunshine.
2 Thursday, ...	26	30·406	59	30·327	62	43	39	56	58	61	59	N. E.	1	. .	Do.
3 Friday	27	30·042	58	29·963	63	37	34	54	57	63	59	S. E.	1	. .	Do.
4 Saturday, ...	28	29·812	60	29·729	63	53	48	56	58	63	60	S. E.	1	. .	Do.
5 Sunday, ...	29	29·612	68	29·508	70	52	49	59	60	69	66	S. E.	3	·190	Do.
6 Monday, ...	●	29·668	61	29·585	67	54	50	58	60	67	64	S. W.	2	·030	Breezy, showery, occasional sunshine.
7 Tuesday, ...	1	29·630	59	29·552	60	52	49	56	58	60	59	S. W.	0	·210	Breezy, showery, changeable.
8 Wednesday, . . .	2	29·540	61	29·457	63	59	54	58	60	63	61	S. W.	0	·030	Cloudy, mild, showery, changeable.
9 Thursday, ...	3	29·564	66	29·465	67	54	49	57	59	66	64	S. E.	3	. .	Breezy, changeable, occasional sunshine.
10 Friday, ...	4	29·264	60	29·182	61	55	50	56	58	60	58	S. W.	2	·060	Do.
11 Saturday, ...	5	29·330	61	29·248	64	48	45	54	57	63	60	S. W.	4	. .	Do.
12 Sunday, ...	6	29·350	56	29·279	60	47	44	53	56	59	54	S. W.	2	·100	Strong, breezy, changeable, occasional suns.
13 Monday, ...	7	29·246	56	29·175	58	47	43	52	55	57	55	N. W.	2	·110	Breezy, showery, changeable, occasional sun.
14 Tuesday, ...	8	29·446	62	29·359	64	51	47	54	55	63	62	S. W.	0	·320	Breezy, cloudy, showery, changeable.
15 Wednesday, . . .	9	29·242	58	29·165	60	51	48	53	55	59	57	S. W.	3	·060	Showery, stormy, changeable, occasional sun.
16 Thursday, ...	10	29·692	59	29·614	61	53	49	53	55	60	57	N. W	2	·050	Fine, breezy, changeable, occasional sunshine.
17 Friday, ...	11	29·560	65	29·466	68	52	49	55	56	67	64	S. W.	2	·100	Fine, mild, changeable, occasional sunshine.
18 Saturday, ...	12	29·122	60	29·042	62	57	51	55	57	61	58	S. W.	0	·550	Stormy, cloudy, changeable.
19 Sunday, ...	13	29·232	53	29·171	54	45	41	51	54	54	51	S. W.	2	·040	Showery, stormy, changeab., occasional sun.
20 Monday, ...	14	29·494	55	29·428	57	42	40	50	53	56	54	N. W.	2	. .	Breezy, cloudy, changeable, occasional sun.
21 Tuesday, ...	15	29·734	57	29·661	60	45	42	50	53	60	58	N. W.	3	. .	Do.
22 Wednesday, . . .	16	29·974	54	29·907	56	45	42	49	52	56	55	S. W.	0	·090	Breezy, showery, cloudy, changeable.
23 Thursday, ...	17	30·016	62	29·926	64	56	52	54	55	64	62	S. W.	0	·060	Do.
24 Friday, ...	18	30·016	66	29·915	69	60	55	57	58	69	66	S. W.	2	. .	Fine, breezy, changeable, occasional sunshine.
25 Saturday, ...	19	29·576	67	29·477	68	57	52	57	58	67	63	S. W.	5	. .	Strong breezy, bright sunshine, fine.
26 Sunday, ...	20	29·776	56	29·703	57	53	49	53	56	57	55	N. W.	0	. .	Breezy, cloudy, changeable, fine day.
27 Monday, ...	21	29·886	60	29·808	62	47	42	53	55	62	59	S. W.	4	·030	Fine, breezy, bright sunshine, fine.
28 Tuesday, ...	22	29·226	54	29·160	56	51	47	52	54	56	55	S. W.	0	·170	Cloudy, breezy, showery, changeable.
29 Wednesday, . . .	23	29·376	57	29·305	59	53	50	53	54	58	57	S. E.	0	·190	Do.
30 Thursday, ...	24	29·560	60	29·477	62	56	51	55	56	62	61	S. E.	0	·160	Cloudy, showery, mild, changeable.
													48	2·550	Inches.

OCTOBER, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Friday, . . .	25	29·598	62	29·510	64	52	49	54	56	63	61	S. E.	3	1·060	Fine, breezy, changeable, occasional sunshine
2 Saturday, . .	26	29·650	61	29 567	64	54	50	56	57	63	61	S. E.	2	·060	Breezy, showery, changeable, occas. sunsh.
3 Sunday, . . .	27	29·918	59	29·840	61	51	47	54	56	60	59	N. W.	2	. .	Fine, mild, cloudy, changeable, occas. sunsh.
4 Monday, . .	28	30·092	61	30·007	65	51	47	55	57	65	63	S. E.	3	. .	Do.
5 Tuesday, . .	●	30·044	60	29·959	62	56	51	56	57	61	60	S. E.	0	. .	Cloudy, mild, changeable day.
6 Wednesday, .	1	30·060	58	29·981	60	58	52	55	56	59	58	S. E.	0	. .	Fine, breezy, cloudy, changeable day.
7 Thursday, . .	2	30·050	61	29·965	64	54	50	55	57	63	62	S. E.	1	. .	Fine, mild, cloudy, changeable, occas. sunsh.
8 Friday, . .	3	30·050	64	29·955	67	55	51	56	58	66	64	N. W.	2	·330	Occasional sun, heavy rain, changeable day.
9 Saturday, . .	4	30·080	65	29·985	68	55	51	57	59	68	66	S. E.	3	. .	Breezy, foggy, changeable, occas. sunshine.
10 Sunday, . .	5	30·038	65	29·934	67	55	51	57	58	67	65	N. E.	2	. .	Fine, mild, changeable, occasional sunshine.
11 Monday, . .	6	30·038	68	29·932	69	58	53	58	59	68	66	N. W.	2	. .	Do.
12 Tuesday, . .	7	30·000	62	29·910	65	59	54	57	59	65	63	S. W.	0	. .	Breezy, cloudy, changeable day.
13 Wednesday, .	8	30·080	50	30·022	51	48	44	53	56	50	48	N. W.	1	·110	Breezy, showery, changeable, occas. sunsh.
14 Thursday, . .	9	30·104	50	30·046	53	42	39	49	53	53	51	S. W.	1	. .	Breezy, cloudy, changeable day.
15 Friday, . .	10	29·638	55	29·571	57	50	49	51	53	56	55	N. W.	1	·030	Do.
16 Saturday, . .	11	29·050	47	29·005	50	43	39	49	52	50	49	N. W.	1	·120	Showery, breezy, cold, changeable day.
17 Sunday, . . .	12	29·874	42	29·838	45	34	32	44	48	44	42	N. W.	2	·040	Breezy, cold, changeable, occasional sunsh.
18 Monday, . .	13	29·248	49	29·187	51	47	37	45	48	51	49	N. W.	1	·220	Breezy, showery, changeable, occas. suns.
19 Tuesday, . .	14	29·928	42	29·892	44	37	34	44	47	44	42	N. W.	2	. .	Breezy, cold, changeable, occas. sunshine.
20 Wednesday, .	15	30·128	47	30·081	50	33	31	42	45	49	48	S. W.	0	. .	Breezy, cloudy, cold, changeable day.
21 Thursday, . .	16	30·328	52	30 292	53	48	44	46	47	53	52	W.	0	·020	Cloudy, mild, changeable day.
22 Friday. . . .	17	30·464	50	30·406	52	48	44	47	49	51	50	N. W	0	. .	Do.
23 Saturday, . .	18	30·250	52	30·214	53	47	43	46	48	53	52	S. W.	0	. .	Breezy, showery, cloudy, changeable day.
24 Sunday, . . .	19	30·278	50	30 220	54	47	44	48	50	54	52	N. W.	2	. .	Fine, mild, changeable, occasional sunshine.
25 Monday, . .	20	30·192	48	30·140	50	38	35	45	48	50	49	N. W.	1	. .	Fine, breezy, changeable, occas. sunshine.
26 Tuesday, . .	21	30·112	44	30·070	46	36	34	44	47	46	43	N. W.	2	. .	Breezy, changeable, cold, occas. sunshine.
27 Wednesday, .	22	29·998	41	29·968	44	36	34	42	45	44	42	N. W.	2	. .	Do.
28 Thursday, . .	23	29·998	41	29·968	43	36	33	40	43	43	42	N. W.	2	. .	Do.
29 Friday, . . .	24	30·300	43	30·264	46	38	35	41	43	46	45	N. W.	0	. .	Cloudy, mild, changeable day.
30 Saturday, . .	25	30·198	51	30·140	52	45	42	44	46	52	51	N. W.	0	·250	Do.
31 Sunday, . . .	26	30·282	51	30·224	52	47	43	45	47	52	51	N. W.	0	. .	Breezy, cloudy, changeable day.
													38	2·240	inches.

NOVEMBER, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETERS.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed height.	Therm.	Cor-rected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Monday, . . .	27	30·300	51	30·242	52	47	43	46	48	52	51	N.W.	0	. .	Breezy, cloudy, changeable day.
2 Tuesday, . . .	28	30·100	52	29·937	54	48	44	47	49	54	52	S.W.	0	. .	Strong breeze, cloudy, changeable day.
3 Wednesday, . .	●	29 920	49	29·868	51	47	44	47	49	51	50	S.W.	0	·020	Fine, mild, cloudy, changeable day.
4 Thursday,. . .	1	29·628	47	29·582	48	46	41	46	48	47	46	N.W.	2	·070	Strong breeze, showery, occasional suns.
5 Friday, . . .	2	29·486	49	29·435	51	41	38	44	47	51	50	S.W.	0	·340	Strong breeze, wet day.
6 Saturday,. . .	3	29·658	44	29·618	47	38	35	44	47	46	45	N.W.	2	·070	Breezy, cold, changeable, occasional suns.
7 Sunday, . . .	4	29·842	42	29·806	44	35	32	41	44	44	43	S.W.	1	·040	Breezy, cloudy, changeable, occasional suns.
8 Monday, . . .	5	29·812	46	29·766	47	44	41	43	45	46	45	N.W.	2	·060	Do.
9 Tuesday, . . .	6	29·812	42	29·775	45	40	37	43	45	45	44	N.W.	2	·260	Do.
10 Wednesday, . .	7	30·000	36	29·980	39	31	29	38	42	39	38	N.W.	1	. .	Breezy, cold, showery, changeable day.
11 Thursday,. . .	8	30·272	37	30·252	42	28	27	37	41	42	40	N.W.	3	. .	Fine, bright sunshine, frost, cold day.
12 Friday,. . . .	9	30·176	42	30·140	48	27	25	37	40	48	45	S.W.	3	. .	Fine, bright sunshine, changeable day.
13 Saturday,. . .	10	29·772	55	29·705	56	47	42	43	44	55	54	S.W.	0	.	Stormy, cloudy, changeable, rain-like day.
14 Sunday, . . .	11	29·800	52	29·738	54	51	47	47	47	54	53	S.W.	0	·180	Breezy, showery, changeable day.
15 Monday, . . .	12	29·798	55	29·731	58	48	44	46	47	58	57	S.W.	0	·200	Do.
16 Tuesday, . . .	13	29·762	50	29·705	53	46	42	46	48	53	51	S.W.	3	. .	Fine, breezy, bright sunshiny day.
17 Wednesday, . .	14	30·112	49	30·060	53	38	33	43	45	53	51	S.W.	2	. .	Breezy, cloudy, changeable, occas. sunshine.
18 Thursday,. . .	15	30 274	56	30·200	58	51	46	47	48	58	56	S.W	3	. .	Fine, breezy, bright sunshiny day.
19 Friday,. . . .	16	30·280	49	30·228	51	47	43	47	48	51	49	N. W.	3	. .	Do.
20 Saturday,. . .	17	30·376	41	30·345	45	36	33	43	46	45	44	N. W.	3	. .	Do.
21 Sunday, . . .	18	29·968	46	29·922	48	36	33	41	44	48	47	S.W.	0	·040	Breezy, light showers, cloudy, changeable day
22 Monday, . . .	19	29·172	40	29·142	42	35	32	41	44	42	41	S.W.	3	·100	Fine, bright sunshine, cold day.
23 Tuesday, . . .	20	29·372	39	29·347	40	31	29	38	41	40	39	N. W.	0	. .	Breezy, cold, cloudy, changeable day.
24 Wednesday, . .	21	29·750	37	29·330	41	31	29	37	40	41	39	N. W.	3	. .	Fine, bright sunshine, cold day.
25 Thursday, . .	22	29·700	42	29·664	45	26	23	36	39	45	45	S.W.	0	·040	Breezy, cloudy, light showers, cold day.
26 Friday,. . . .	23	29·678	42	29·642	45	41	38	40	41	45	44	S.W.	0	. .	Breezy, cloudy, changeable day.
27 Saturday,. . .	24	29·482	42	29·447	44	42	39	40	42	44	44	S. E.	0	·340	Cloudy, wet, changeable day.
28 Sunday, . . .	25	29.642	41	29·612	43	38	35	40	42	43	42	N. W.	2	·030	Breezy, cold, changeable, occas. sunshine.
29 Monday, . . .	26	29·600	35	29.585	38	31	29	37	40	37	36	S. E.	0	·100	Cloudy, cold, wet, changeable day.
30 Tuesday, . . .	27	29·950	35	29·935	39	31	28	37	40	39	38	N. W	3	·240	Breezy, cold, changeable, occasional sunshine
													41	2·130	inches.

DECEMBER, 1869.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Wednesday, . .	28	30·194	35	30·179	38	31	29	35	38	38	37	N.W.	3	. .	Breezy, cold, changeable, occas. sunshine.
2 Thursday, . .	29	29·808	31	29·804	35	25	22	33	35	35	34	E.	0	·050	Cloudy, wet, frosty, changeable day.
3 Friday, ...	●	30·000	37	29·980	39	35	33	35	37	39	38	S E.	0	·300	Cloudy, breezy, cold, changeable day.
4 Saturday, . . .	1	30·072	32	30·063	35	29	26	33	36	35	34	N.W.	0	. .	Cloudy, cold, frosty, changeable day.
5 Sunday, . . .	2	30·468	37	30·448	40	32	28	35	37	39	38	N.E.	1	. .	Cloudy, cold, changeable, occas. sunshine.
6 Monday, . . .	3	30·444	42	30·408	43	36	31	36	38	43	42	N.E.	0	. .	Cloudy, cold, changeable day.
7 Tuesday, . . .	4	30·144	42	30·108	44	41	36	37	39	43	42	N.E.	1	. .	Breezy, changeable, occasional sunshine.
8 Wednesday, . .	5	29·850	43	29·814	46	41	38	38	40	45	45	S.E.	1	. .	Do.
9 Thursday, . . .	6	29·884	42	29·848	43	42	41	39	41	43	42	N E.	0	. .	Cloudy, mild, changeable day.
10 Friday, ...	7	29·650	43	29·614	46	38	34	39	41	45	44	S.E.	0	. .	Breezy, cloudy, changeable day.
11 Saturday, . . .	8	29·300	40	29·270	42	39	35	39	42	42	41	N.W.	2	·320	Breezy, changeable, occasional sunshine.
12 Sunday, . . .	9	29·282	40	29·252	43	33	29	38	40	42	42	S.W.	3	·060	Fine, breezy, bright sunshine.
13 Monday, . . .	10	28·792	41	28·763	52	40	36	40	41	50	49	S.W.	1	·040	Strong breeze, changeable, occas. sunshine.
14 Tuesday, . .	11	29·288	40	29·258	48	38	34	39	41	42	41	S.W.	1	·100	Breezy, showery, changeable, occas. sunshine.
15 Wednesday, . .	12	29·300	38	29·275	40	37	33	37	40	39	39	S.W.	1	·190	Do.
16 Thursday, . . .	13	29·320	44	29·279	45	36	32	37	39	45	44	S.W.	0	·060	Breezy, cloudy, changeable day.
17 Friday, ...	14	29·662	40	29·632	43	36	32	37	39	43	42	S W.	2	·260	Breezy, changeable, occasional sunshine.
18 Saturday, . . .	15	29·100	56	29·029	57	41	37	42	42	56	55	S W.	0	·440	Breezy, showery, changeable day.
19 Sunday, . . .	16	29·040	39	29·015	40	38	35	39	42	40	39	S.W.	1	·060	Breezy, showery, changeable, occas. sunshine.
20 Monday, . .	17	29·416	39	29·391	43	37	33	38	40	43	43	S.W.	2	. .	Breezy, changeable, occas. sunshine.
21 Tuesday, . . .	18	29·450	33	29·441	35	30	28	35	38	35	35	N.W.	2	·060	Do.
22 Wednesday, . .	19	29·774	34	29·759	38	31	28	34	37	38	37	N.W.	2	. .	Do.
23 Thursday, . .	20	30·112	36	30·092	39	32	29	35	37	39	38	N.W.	3	. .	Breezy, cold, bright sunshine.
24 Friday, ...	21	30·188	35	30·173	39	30	27	34	37	39	38	N.W.	3	. .	Do.
25 Saturday, . . .	22	29·940	34	29·889	39	29	26	34	37	39	38	N.W.	3	. .	Fine, calm, bright sunshine.
26 Sunday, . . .	23	29·700	34	29·685	35	28	25	32	35	35	34	N.W.	0	. .	Strong breeze, showers of hail, changeable.
27 Monday, . . .	24	29·840	32	29·831	34	30	26	31	33	34	33	N.W.	1	. .	Breezy, showers of snow, occas. sunshine.
28 Tuesday, . . .	25	29·842	21	29·865	28	16	13	30	34	29	28	N.W.	3	. .	Fine, bright sunshine, frosty day.
29 Wednesday, . .	26	29·750	34	29·714	46	28	25	32	34	46	45	S.W.	1	. .	Breezy, changeable, occas. sunshine.
30 Thursday, . . .	27	29·180	46	29·135	48	45	39	37	37	47	46	S E.	0	·070	Stormy, showery, changeable day.
31 Friday, ...	28	29·300	40	29·270	42	39	35	37	39	42	41	S.W.	1	·240	Breezy, changeable, occasional sunshine.
													38	2·250	

JANUARY, 1870.

DATE. Day, At 12 o'Clock, P. M.	MOON'S AGE.	BAROMETER. Observed Height.	BAROMETER. Therm.	BAROMETER. Corrected.	THERMOMETER. Max.	THERMOMETER. Min.	THERMOMETER. On Grass.	THERMOMETER. In Earth. 5 in.	THERMOMETER. In Earth. 10 in.	THERMOMETER. Dry.	THERMOMETER. Wet.	WIND. Direction.	HOURS OF SUNSHINE.	RAIN IN INCH	WEATHER, AND GENERAL REMARKS.
1 Saturday, . .	●	29·076	48°	29·041	46°	40	36°	38	39	45	44°	S. E.	2	·070	Fine, mild, changeable, occasional sunshine.
2 Sunday, . . .	1	29·484	41	29·404	18	41	38	38	39	43	42	S. W.	0	·100	Cloudy, mild, changeable day.
3 Monday, . . .	2	29·450	40	29·420	43	36	33	37	40	48	42	S. E.	2	. .	Fine, mild, changeable, occasional sunshine.
4 Tuesday, . . .	3	29·362	44	29·322	45	41	36	38	40	44	43	S. W.	0	·060	Stormy, showery, changeable day.
5 Wednesday, . .	4	29·578	39	29·558	43	36	32	37	39	43	42	S. W.	2	. .	Fine, mild, changeable, occasional sunshine.
6 Thursday, . .	5	29·896	46	29·851	49	33	29	38	39	49	48	S. W.	2	·270	Breezy, showery, occasional sunshine.
7 Friday, . . .	6	29·246	42	29·211	44	40	36	38	40	44	44	S. W.	0	·090	Breezy, cloudy, changeable day.
8 Saturday, . .	7	28·818	42	28·784	44	42	39	39	41	43	42	S. W.	0	·340	Breezy, showery, changeable day.
9 Sunday, . . .	8	29·490	42	29·455	44	38	35	38	40	44	43	N. W	0	. .	Breezy, cloudy, changeable day.
10 Monday, . . .	9	29·840	32	29·831	36	28	26	35	38	36	35	N. W.	3	.	Fine, bright sunshine, frosty day.
11 Tuesday, . . .	10	29·692	41	29·662	44	29	26	35	37	44	43	S. W.	0	·060	Breezy, showery, changeable day.
12 Wednesday, .	11	29·670	35	29·655	37	33	30	34	37	37	56	W.	2	·020	Breezy, cold, occasional sunshine.
13 Thursday, . .	12	29·656	33	29·647	38	31	28	33	36	38	37	S. E.	0	. .	Foggy, mild, changeable, rain-like day.
14 Friday, . .	13	29·094	43	29·059	45	36	33	37	38	45	44	S. W.	1	·140	Breezy, changeable, occasional sunshine.
15 Saturday, . .	14	29·630	40	29·600	44	38	38	37	39	44	43	N. W.	0	·060	Fine, mild, changeable day.
16 Sunday, . . .	15	30·048	51	29·990	55	44	38	41	41	55	53	S. W.	2	. .	Fine, mild, changeable, occasional sunshine.
17 Monday, . . .	16	30·388	46	30·341	49	40	35	40	41	49	48	S. W.	0	. .	Fine, mild, changeable day.
18 Tuesday, . . .	17	30·466	45	30·424	47	44	40	41	42	47	46	S. E.	0	. .	Fine, mild, foggy, changeable day.
19 Wednesday, . .	18	30·450	40	30·419	41	40	38	40	42	40	40	S. E.	0	·050	Breezy, cold, showery, changeable day.
20 Thursday, . .	19	30·416	35	30·401	36	36	32	37	35	35	34	S. E.	0	. .	Breezy, cold, changeable day.
21 Friday, . . .	20	30·350	34	30·335	38	33	31	35	37	34	34	N. E.	0	. .	Cloudy, cold, showers of snow.
22 Saturday . . .	21	30·466	32	30·457	32	32	29	33	36	33	33	N. W.	0	. .	Cloudy, very cold day.
23 Sunday, . . .	22	30·478	38	30·452	41	33	31	34	36	42	41	S. W.	0	. .	Fine, mild, cloudy, changeable day.
24 Monday, . . .	23	30·450	40	30·419	42	35	30	36	38	42	41	N. E.	3	. .	Fine, mild, bright sunshine.
25 Tuesday, . . .	24	30·400	31	30·396	34	27	24	33	36	34	34	S. W.	0	. .	Cloudy, calm, changeable, frost.
26 Wednesday, . .	25	30·284	34	30·269	39	28	24	33	36	39	38	S. E.	3	. .	Fine, bright sunshine, frost.
27 Thursday, . .	26	30·100	37	30·080	42	25	22	32	35	42	41	S. W.	1	. .	Breezy, changeable, occasional sunshine.
28 Friday, . . .	27	29·866	40	29·830	42	37	30	34	35	42	41	S. W.	0	. .	Breezy, cloudy, changeable day.
29 Saturday, . .	28	29·886	41	29·806	43	39	35	35	36	42	40	S. E.	1	. .	Breezy, changeable, occasional sunshine.
30 Sunday, . . .	29	29·528	44	29·487	46	40	35	36	37	46	45	S. E.	0	·060	Strong breeze, showery, changeable day.
31 Monday, . . .	●	29·250	47	29·205	50	42	35	39	40	50	48	S. W.	3	·530	Breezy, bright sunshine, heavy rain.
													27	1·850	inches.

FEBRUARY, 1870.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Corrected.	Max.	Min.	On Grass.	In Earth.		Dry.	Wet.	Direction.			
								5 in.	10 in.						
			°		°	°	°	°	°	°	°				
1 Tuesday, . .	1	29·512	48	29·476	45	36	30	37	49	44	43	S. E.	0	. .	Breezy, cloudy, rain-like day.
2 Wednesday, .	2	29·326	45	29·286	47	43	38	39	40	47	46	S. E.	1	. .	Breezy, cloudy, changeable, occas. sunsh.
3 Thursday, . .	3	29·540	36	29·520	40	31	29	37	39	40	39	S. E.	1	. .	Foggy, changeable, occasional sunshine.
4 Friday, . . .	4	29·300	46	29·255	47	41	39	39	40	46	46	S. E.	0	·070	Showery, cloudy, changeable day.
5 Saturday, . .	5	29·678	38	29·652	41	34	30	37	39	41	40	S. W.	1	·050	Cloudy, changeable, occas. sunshine.
6 Sunday, . . .	6	29·320	48	29·269	50	34	30	39	40	50	49	S. E.	0	·060	Breezy, showery, changeable day.
7 Monday, . . .	7	29·362	42	29·327	45	33	30	39	41	45	44	S. E.	1	·100	Breezy, showery, occasional sunshine.
8 Tuesday, . . .	8	29·338	42	29·303	45	41	36	39	41	45	44	N. E.	0	·040	Breezy, showery, changeable day.
9 Wednesday, .	9	29·644	38	29·621	40	38	35	38	40	40	39	N. E.	0	·050	Breezy, cloudy, showers of snow.
10 Thursday, . .	10	30·100	31	29·096	33	30	26	34	37	33	32	N. E.	0	. .	Breezy, cold, changeable day.
11 Friday, . . .	11	30·350	34	30·303	36	33	29	34	37	36	35	N. E.	0	. .	Cloudy, cold, changeable day.
12 Saturday, . .	12	30·426	34	30·411	35	29	27	34	37	34	33	N. E.	1	·050	Breezy, occasional suns., showers of snow.
13 Sunday, . . .	13	30·280	31	30·282	31	30	26	31	34	31	30	N. E.	0	. .	Breezy, cold, showers of snow.
14 Monday, . . .	14	30·138	33	30·134	34	31	28	32	32	34	33	N. E.	0	. .	Breezy, cold, changeable day.
15 Tuesday, . .	15	30·242	38	30·216	40	34	31	38	34	40	39	N. E.	3	. .	Fine, breezy, bright sunshiny day.
16 Wednesday, .	16	30·160	40	30·129	42	36	30	34	36	42	40	N. E.	1	. .	Cloudy, changeable, occas. sunshiny day.
17 Thursday, . .	17	30 114	36	30·094	38	36	34	34	36	37	36	N. E.	0	. .	Breezy, cloudy, cold day.
18 Friday, . . .	18	29·998	36	29·978	39	35	33	34	36	39	38	S. W.	0	. .	Cloudy, cold, changeable day.
19 Saturday, . .	19	30·046	40	30·011	42	35	38	35	37	42	41	N. E.	2	. .	Breezy, changeable, occasional sunshine.
20 Sunday, . . .	20	31·038	41	30·107	44	35	31	34	37	44	43	S. W.	3	.	Fine, breezy, changeable, occas. sunshine.
21 Monday, . .	21	29·790	38	29·760	44	39	35	36	38	43	42	S. W.	1	·020	Breezy, showery, occasional sunshine.
22 Tuesday, . .	22	29·826	45	29·801	41	34	31	35	37	41	49	S. W.	2	. .	Fine, changeable, occasional sunshine.
23 Wednesday, .	23	29·950	44	29·410	48	38	33	37	38	47	46	N. W.	2	. .	Do.
24 Thursday, . .	24	29·300	41	29·260	46	40	36	38	37	45	44	N. W.	2	·040	Breezy, changeable, occasional sunshine.
25 Friday, . . .	25	29·444	40	29·604	45	30	28	35	37	44	43	S. W.	2	. .	Do.
26 Saturday, . .	26	28·850	42	29·850	48	32	29	35	38	48	42	S. W.	3	·060	Fine, breezy, bright day.
27 Sunday, . . .	27	29·194	42	29 159	45	35	29	36	38	44	43	S. E.	0	·140	Cloudy, mild, changeable, rain-like day.
28 Monday, . .	28	29 194	47	29·149	50	44	40	39	40	50	49	S. W.	2	·100	Breezy, showery, occasional sunshine.
													28	·780	

MARCH, 1870.

DATE.	MOON'S AGE.	BAROMETER.			THERMOMETER.							WIND.	HOURS OF SUNSHINE.	RAIN IN INCH.	WEATHER, AND GENERAL REMARKS.
Day, At 12 o'Clock, P. M.		Observed Height.	Therm.	Cor-rected.	Max.	Min.	On Grass.	In Earth. 5 in.	In Earth. 10 in.	Dry.	Wet.	Direction.			
			°		°	°	°	°	°	°	°				
1 Tuesday, . . .	29	29·350	46	29·305	50	40	36	40	42	50	49	S. W.	8	·060	Fine, breezy, bright sunshine.
2 Wednesday, . .	●	29·508	40	29·478	43	39	35	39	41	42	41	N. E.	0	·080	Breezy, showery, changeable.
3 Thursday, . . .	1	29·608	36	29·588	37	36	34	39	40	36	35	N. E.	0	·940	Breezy, cold, wet.
4 Friday, ...	2	30·000	40	29·969	42	35	33	37	39	42	41	N. E.	2	·320	Breezy, changeable, occasional sunshine.
5 Saturday, . . .	3	30·220	39	30·174	43	35	32	36	38	43	41	N. E.	2	. .	Do.
6 Sunday, . . .	4	30·462	45	30·422	47	34	29	37	39	47	45	N. E.	5	. .	Fine, breezy, bright sunshine.
7 Monday, . . .	5	30·392	42	30·356	45	31	28	37	38	44	43	N. E.	3	. .	Breezy, changeable, occasional sunshine.
8 Tuesday, . . .	6	30·368	42	30·302	44	33	29	37	39	44	43	N. E.	2	. .	Do.
9 Wednesday, . .	7	30·262	44	30·220	49	36	31	38	40	49	47	N. E.	2	. .	Do.
10 Thursday, . . .	8	30·168	44	30·126	48	34	31	38	40	48	46	N. W.	2	. .	Do.
11 Friday, ...	9	29·896	44	29·855	46	34	31	39	40	46	44	N. W.	1	. .	Do.
12 Saturday, . . .	10	29·784	39	29·759	40	31	28	36	39	39	38	N. W.	1	. .	Cloudy, cold, changeable, occasional sun.
13 Sunday, . . .	11	29·800	39	29·775	42	28	26	36	39	42	40	N. W.	5	·100	Breezy, cold, bright sunshine.
14 Monday, . . .	12	29·900	39	29·875	44	26	28	34	37	44	43	S. W.	2	. .	Breezy, foggy, changeable, occasional sun.
15 Tuesday, . . .	13	29·540	47	29·494	48	40	36	38	39	47	46	S. W.	0	·070	Breezy, showery, changeable.
16 Wednesday, . .	14	29·450	50	29·394	51	47	42	42	42	51	50	S. W.	0	·050	Breezy, cloudy, changeable.
17 Thursday, . . .	15	29·788	54	29·726	55	49	45	44	44	54	53	S. W.	1	. .	Breezy, changeable, occasional sunshine.
18 Friday, ...	16	30·176	51	30·118	53	44	40	44	45	52	51	S. W.	8	. .	Do.
19 Saturday, . . .	17	30·350	58	30·287	56	34	32	43	45	56	54	S. E.	5	. .	Fine, bright sunshine, very mild.
20 Sunday, . . .	18	30·350	52	30·287	53	45	39	44	45	53	52	S. W.	1	. .	Fine, mild, cloudy, occasional sunshine.
21 Monday, . . .	19	30·214	51	30·156	53	46	40	45	46	52	50	S. W.	0	. .	Breezy, cloudy, changeable.
22 Tuesday, . . .	20	29·928	48	29·892	48	41	36	44	45	42	41	N. E.	0	·110	Breezy, showery, changeable.
23 Wednesday, . .	21	30·150	38	30·124	41	32	28	39	42	40	39	N. E.	1	. .	Breezy, cold, occasional sunshine.
24 Thursday, . . .	22	29·944	39	29·919	41	33	28	37	40	40	40	S. W.	0	. .	Breezy, cold, changeable, rain-like.
25 Friday, ...	23	29·796	42	29·760	44	35	30	39	41	43	41	N. E.	4	·170	Fine, breezy, bright sunshine.
26 Saturday, . . .	24	30·000	42	29·964	46	29	25	39	41	46	44	N. E.	4	. .	Do.
27 Sunday, . . .	25	30·264	44	30·222	50	25	21	37	40	50	49	S. W.	8	. .	Fine, mild, changeable, occasional sunshine.
28 Monday, . . .	26	30·378	48	30·326	51	41	35	40	41	50	49	N. W.	0	·050	Cloudy, mild, changeable.
29 Tuesday, . . .	27	30·364	47	30·317	49	44	38	42	43	49	48	S. E.	0	·020	Do.
30 Wednesday, . .	28	30·250	48	30·198	51	42	36	43	44	51	49	S. E.	0	. .	Do.
31 Thursday, . . .	29	30·200	54	30·182	58	47	40	45	46	58	55	S. W.	1	. .	Do., occasional sunshine.
													58	1·920	inches.

INDEX.

ACCLIMATION of plants. *See* Mr. Adair.
Adair, Mr. J., on the acclimation of plants, 481.
Agricultural Museum, donations to, 61, 404.
Alloway, Mr., on peat, and its profitable utilization, 281.
—— method of preparing peat, 283.
Analysis, spectrum, as applied to heavenly bodies, 500.
Andrews, Mr. Wm., on a cetacean new to Ireland, 188.
—— on certain woods and timber trees of New Zealand, 221.
—— on pines of New Zealand, 228.
—— on the herring fisheries of Ireland, 12.
—— on the habits of the herring, 16.
—— on the spawning of the herring, 17.
—— on certain branches of Irish industry, 192.
—— on fisheries of Ireland as a branch of industry, 199.
—— on the ichthyology of the south-west coast of Ireland, 879.
—— specimens of fish obtained by, 881.
—— on deep sea soundings, 475.
Animals, vertebrate, symmetry in, 886.
—— observed in Kerry, 890.
Apparatus for estimation of carbonic acid, and valuation of manganese ores. *See* Dr. Reynolds.
Associations, co-operative farming. *See* Mr. Hayes.
Atlantic Ocean, physical geography of. *See* Dr. Barry.

Bagot, Mr. J., remarks of, on Mr. Baruchson's paper on beet sugar, 862.
Ball, Prof. R. S., on nebulæ, 889.
—— on nature of nebulæ, 848.
—— on colour of nebulæ, 844.
—— on smoke wreaths, 275.
—— on a fluid removed from the action of gravity, 409.
—— on the differential and epicycloidal pulley blocks, 543.
Barrett, Mr. W. F., on musical and sensitive flames, 255.
Barrington, Mr., remarks of, on herring fisheries of Ireland, 28.
Barry, Dr., remarks of, on Mr. Adair's paper, 528.
—— on the Australian aborigines, 542.
—— on the physical geography of the South Atlantic, 277.
—— on submarine earthquakes and volcanoes, 26.
Baruchson, Mr. E., on beet root sugar manufacture in Ireland, 348.
—— on the progress of the beet root sugar manufacture, 349.
—— on the suitability of Ireland for the growth of beet, 351.
Beggs, Mr., remarks of, on Dr. Mapother's paper, 48.
Blood, wonders of the, and its circulation. *See* Dr. Mapother.
Bodies, heavenly, spectrum analysis of, 500.
Bombyx, Yama-maï. *See* Dr. de Ricci.
—— ——. *See* Mr. More.
—— Cynthia. *See* Mr. Kirby.
Botanic Gardens, donations to, 57, 143, 235, 405, 518.

Cameron, Dr., on rubidia in plants, 85.
—— remarks of, on Mr. Baruchson's paper, 864.
Cassegrainian reflectors, 463.
Cattle Show, Spring, announcement of prizes awarded at, 154, 424.
Cetacean new to Ireland. *See* Mr. Andrews.
Circulation of blood. *See* Dr. Mapother.
Climate of Port Natal, observations of Dr. Mann on, 211.
Collections made in Kerry. *See* Mr. More.
Comets, spectrum analysis of, 504.
Copland, Mr., observations of, on Mr. Alloway's paper, 288.
Countries which adopted Metric System, 293.

k

Corrigan, Sir D. J., observations of, on Mr. More's paper, 394.
Cruise, Dr., exhibited an electro-motor engine, 407.
Cullen, Dr., on the Darien Canal line, 117.
—— description of Darien Isthmus, 118.
—— line of the Canal, 122.
—— geology of Darien Isthmus, 124.
—— cost of Canal, 126.
—— climate, 128.
Currents of the South Atlantic, 279.
Curves of the human spine, æsthetical relations of, 508.

Daly, Mr. William, remarks of, on Dr. Mapother's paper, 48.
Darien Canal line. *See* Dr. Cullen.
Davy, Prof. E. W., on the chemistry of poplar bark and leaves, 66.
—— exhibited Scheller's apparatus for estimating carbonic acid, 67.
De Ricci, Dr., observations of, on petroleum oils, 541.
—— on the culture of the *Bombyx yamamaï*, 172.
—— on the introduction of *Bombyx yamamaï*, 174.
Dillon, Mr. T., on a method for preparing parchment for title deeds, 67.
—— on a method for flushing sewers, 274.
Discovery of an isomer of sulphocyanogen. *See* Dr. Reynolds.
Distribution of prizes, School of Art, 1866, 147.
—— do. 1867, 263.
—— do. 1869, 410, 522.
—— of blood through the body. *See* Dr. Mapother.
Donations to Royal Dublin Society, 49, 140, 231, 395, 512.
Dwellings, labourers', 35.

Earthquakes, submarine. *See* Dr. Barry.
Egan, Mr. J., exhibited a model of flax-scutching machine, 67.
Estimation of carbonic acid, and valuation of manganese ores. *See* Dr. Reynolds.
Excursion, Natural History. *See* Mr. Kirby.

Farming associations, co-operative. *See* Mr. Hayes.
Ferguson, Mr., remarks of, on Mr. Adair's paper, 538.
Fine Arts Committee, report of, 264, 411.
Fine Arts Department, donations to, 61.
Fisher, Mr. Joseph, on production of food, 76.
Fisheries, herring, of Ireland. *See* Mr. Andrews.
—— mackerel. *See* Mr. Hoare.
—— pilchard. *See* Mr. Hoare.
Flames, musical and sensitive. *See* Mr. Barrett.
Flanelly, Mr., on weights and measures, and arithmetical calculations, 290.
Flora, miocene, of North Greenland. *See* Mr. Heer.
Foot, Mr. F. J., on a tour in Norway, 96.
—— plants of Norway, 97.
—— geology of Norway, 99.
—— visit to the Nygaard glacier, 107.

Galbraith, Rev. J. A., observations of, on Mr. Alloway's paper, 288.
—— on the Metric System, 291.
—— remarks of, on Mr. Flanelly's paper, 290.
Gas, hydrogen, as a metal and as a, 455.
Geography, physical, of the South Atlantic. *See* Dr. Barry.
Glacier, Nygaard, observations of Mr. Foot on, 107.
Goode, Mr., observations of, on Mr. Baruchson's paper, 364.
Greenland, miocene Flora of. *See* Prof. Heer.
Grogan, Sir E., remarks of, on herring fisheries, 24.
Grubb, Mr. H., on a recently-observed meteor, 444.
—— on the great Melbourne telescope, 460.
—— Gregorian reflectors, 462.
—— Newtonian reflectors, 462.
—— Cassegrainian reflectors, 463.
—— Herschellian reflectors, 463.
—— exhibited drawings of Nebula in η Argos, 541.

Handcock, Hon. George, speech of, at distribution of prizes, School of Art, 152.
Haughton, Mr. James, remarks of, on Mr. Baruchson's paper, 362.
Hayes, Mr. James, co-operative farming associations, 489.
Heer, Prof. O., on miocene Flora of North Greenland, 69.
Hemisphere, extra-tropical, Lepidoptera of, 163.
Hennessy, Prof., on climate of Ireland in reference to cultivation of flax, 542.

Herring fisheries of Ireland, 12.
Herschellian reflectors, 463.
Hoare, Mr. J., on the sea fisheries of Ireland, 1.
—— progress of mackerel fisheries, 7.
—— pilchard fisheries, 9.
Huggins, Mr., on spectrum analysis as applied to heavenly bodies, 500.
—— use of spectroscope, 501.
—— spectrum analysis of comets, 504.
Hull, Mr. E., exhibited flint arrow heads, 541.
Hutton, Mr. D., remarks of, on Mr. Baruchson's paper, 363.
Hydrogen as a gas and as a metal. *See* Dr. Reynolds.

Ichthyology of the south-west coast of Ireland. *See* Mr. Andrews.
Intelligence, 62, 147, 241, 407, 522.
Ireland, cetacean new to, 188.
—— beet root sugar manufacture in, 348.
—— co-operative farming associations in, 489.
Irish, certain branches of, industry, 192.
Isomer of sulphocyanogen. *See* Dr. Reynolds.
Isthmus of Darien, description of, 118.

Japanese oak-feeding silkworm. *See* Dr. de Ricci.
—— *See* Mr. More.
Jephson, Mr. R. H., remarks of, on Dr. Mapother's paper, 48.

Kane, Sir Robert, observations of, on Mr. Baruchson's paper, 365.
Kerry, collections made in. *See* Mr. More.
Kirby, Mr. W. F., on diurnal Lepidoptera, 163.
—— on *Bombyx Cynthia*, 366.
—— on a natural history excursion to the Continent, 436.
—— animals collected by, 441.
Kohl-Rabi. *See* Dr. Moore.

Labourers' dwellings. *See* Dr. Mapother.
Law of symmetry in animal forms, 327.
Lepidoptera, diurnal. *See* Mr. Kirby.
Lewis, Mr. F., on the cultivation of flowers for distillation, 542.
Library, donations to, 49, 140, 231, 395, 512.
Lord Lieutenant, speech of, on School of Art, 272.

Macalister, Dr. A., on the typical Irish skull, 409.
—— on the æsthetical relations of the curves of the human spine, 508.
—— on the law of symmetry in animal forms, 327.
—— symmetry of the mineral world, 329.
—— definition of symmetry, 330.
—— symmetry of shells, 332.
—— symmetry in vertebrate animals, 336.
Mackerel fisheries, progress of, 7.
Maclean, Mr. H., remarks of, on Dr. Mapother's paper, 48.
Mann, Dr. J., on the colony of Natal, 275.
—— on the physical geography, geology, and mineralogy of Natal, 206.
—— description of Port Natal, 207.
—— climate of Natal, 211.
—— rain-fall of Port Natal, 213.
Manufacture of beet root sugar in Ireland. *See* Mr. Baruchson.
Manures, estimation of soluble and insoluble phosphates in. *See* Dr. Reynolds.
Mapother, Dr., on labourers' dwellings, 35.
—— on the wonders of the blood, 300.
—— analysis of blood, 301.
—— on the distribution of blood through the body, 306.
—— Mr., exhibited plans for labourers' dwellings, 49.
Melbourne telescope. *See* Mr. Grubb.
Metal, hydrogen, as a gas and as a, 455.
Meteor, recently observed. *See* Mr. Grubb.
Meteoric showers. *See* Mr. Stoney.
Meteorological tables. *See* Appendix.
Meters for the supply of water. *See* Mr. Sanders.
Metric System, 291.
—— importance of, 291.
—— establishment of, 292.
—— progress of, 293.
—— countries which have adopted, 293.
—— tables of, 297.
M'Gowan, Mr. M., remarks of, on herring fisheries of Ireland, 24.
Moore, Dr., exhibited plants analogous to those referred to by Prof. Heer, 161.
—— exhibited *Cratægus oxycanthus*, 407.
—— remarks of, on Mr. Adair's paper, 538.
—— on *Orchis mascula*, 34.
—— botanical and horticultural notes of, 241, 247.
—— on growing *Kohl-Rabi*, 373.
—— on Mr. Waldron's method of growing *Kohl-Rabi*, 374.
More, Mr. A. G., exhibited specimens of *Scirpus pavulus*, 407.

More, Mr. A. G., on collections made in Kerry, 389.
—— animals observed in Kerry, 390.
—— on *Bombyx Yama-maï*, 486.
Murray, Mr., remarks of, on Mr. Kirby's paper, 369.
Museum of Natural History, donations to, 145, 237, 462, 521.

Natal, physical geography, geology, and mineralogy of Port. *See* Dr. Mann.
—— on the colony of. *See* Dr. Mann.
Nebulæ. *See* Prof. Ball.
Newtonian reflectors, 462.
Norway, tour in. *See* Mr. F. J. Foot.
Nygaard glacier, observations on, 107.

Orchis mascula. *See* Dr. Moore.
Ores, manganese, valuation of. *See* Dr. Reynolds.

Papier Leptographique, Dr. Reynolds exhibited, 161.
Peat, and its profitable utilization, 281.
Phosphoric acid, estimation of, in minerals and agricultural phosphates. *See* Dr. Reynolds.
Pilchard fisheries, 9.
Pines of New Zealand, 223.
Plants, acclimation of. *See* Mr. Adair.
Purser, Prof., on the vibrations which give rise to musical sounds, 429.
—— on rate of sound-wave, 430.
—— experiments with monochord, 431.

Rain-fall of Port Natal, 218.
Report of School of Art, 62, 147, 263, 410, 522.
—— of Fine Arts Committee, 147, 264, 411, 523.
—— of Spring Cattle Show, 154, 424.
—— of judges of Taylor prizes, 65, 152, 272.
—— of Dr. Carte and Dr. Reynolds on Continental museums, 260.
Reynolds, Dr. J. E., on certain absorption spectra, 89.
—— on apparatus for estimation of carbonic acid and valuation of manganese ores, 138.
—— exhibited experiments with magnesium light, 409.
—— exhibited absorption spectrum of jargonium, 409.
—— on the discovery of an isomer of sulphocyanogen, 114.
Reynolds, Dr. J. E., on a new form of spectroscope for examination of minerals, 178.
—— description of way that the spectroscope acts by, 179.
—— on estimation of phosphoric acid in minerals and agricultural phosphates, 180.
—— exhibited specimens of minerals from Giant's Causeway, 541.
—— on the flashing point of petroleum oils, 541.
—— exhibited a new light, 541.
—— on the action of heat on sulphocyanate of ammonium, 370.
—— on the estimation of soluble and insoluble phosphates in phosphate manures, 376.
—— on hydrogen as a gas and a metal, 455.
—— on a method of extracting oil and fat from feeding cakes, 409.
Robinson, Mr. J. W., exhibited some etched negatives, 409.
Root, beet, sugar. *See* Mr. Baruchson.

Sanders, Mr., on meters for supply of water, 183.
School of Art, report of, 62, 147, 263.
Sea, physical geography of. *See* Dr. Barry.
—— deep, soundings. *See* Mr. Andrews.
Shaw, Prof., remarks of, on Mr. Andrews' paper, 24.
Shells, symmetry of, 332.
Silkworms, oak-feeding. *See* Dr. de Ricci.
—— ailanthus-feeding. *See* Mr. Kirby.
Smith, Dr. W. G., on black wax, 227.
—— chemical examination of black wax, 229.
Soundings, deep sea. *See* Mr. Andrews.
Sounds, musical, vibrations which give rise to. *See* Prof. Purser.
Spawning of herring, Mr. Andrews on, 17.
Spectroscope, new form of. *See* Dr. Reynolds.
Spectrum analysis as applied to heavenly bodies. *See* Mr. Huggins.
Speculum, mode of grinding, 470.
Spine, human, æsthetical relations of the curves of, 508.
Sproule, Mr. S., remarks of, on Mr. Alloway's paper, 288.
Stoney, Mr. G. J., on discoveries in meteoric astronomy, 163.
—— remarks on Mr. Adair's paper, 540.
—— on meteoric showers, 307.
—— regions from which meteors come, 308.
—— on the orbit of the great November shower, 308.

Stoney, Mr. G. J., on a universal money of account, and national coinage, 409.
Substitution of rubidia for potash in plants. *See* Dr. Cameron.
Sugar, beet root. *See* Mr. Baruchson.
Sullivan, Prof., remarks of, on Mr. Baruchson's paper, 363.
Symmetry in animal forms. *See* Dr. Macalister.

Telescope, Melbourne, Mr. Grubb on, 460.
Thermo-electric battery, Mr. Yeates exhibited, 162.
Thomson, Prof. W., on the depths of the sea, 316.
—— on the cruise of the "Lightning," 318.
—— on chalk mud and chalk, 319.
—— on chalk flints, 321.
—— on the conditions of the depths—pressure, 323.
—— on nutrition, 325.
Tour in Norway, Mr. F. J. Foot on a, 96.

Vereker, Mr., remarks of, on Mr. Flanelly's paper, 290.

Waldron, Mr., remarks of, on Mr. Baruchson's paper, 362.
Walsh, Mr. J., remarks of, on herring fisheries of Ireland, 23.
Water, meters for supply of. *See* Mr. Sanders.
Wax, black. *See* Dr. Smith.
Weights and measures, metric system of. *See* Rev. J. Galbraith.
Wilde's electro-magnetic machine, exhibited by Dr. Barker, 162.
Wilson, Mr., observations of, on Mr. Hayes' paper, 542.
Wonders of blood, and its circulation. *See* Dr. Mapother.
Wright, Dr. E. P., remarks of, on Prof. Heer's paper, 161.
—— observations of, on Mr. More's paper, 395.
—— exhibited coco-de-mer, 409.
—— observations of, on Mr. Adair's paper, 540.

Yeates, Mr. S., exhibited a new zirconium light, 409.
—— on a new thermo-electric pile, 543.
—— on a printing telegraph, 543.

Zealand, New, on certain timber trees of. *See* Mr. Andrews.
Ziphius Sowerbyi, discovery of, in Ireland, 188.

END OF VOL. V.

ELESCOPE.

. R. S.

Royal Dublin Society—continued.

II.—Departments of the Society.

1. *Agriculture.*

a. **The Annual Show** of Cattle, Poultry, and Implements, is held in Spring.

b. **The Winter Show** of Farm and Dairy Produce is held in December.

c. **Annual Show of Horses and Sheep** in Autumn.

d. **Chemical Analyses** of Agricultural Produce, Soils, Manures, &c., are performed in the Laboratory.

e. **The Agricultural Museum** open daily (Sundays excepted) from 11 to 4 o'Clock.

III.—Botanic Gardens and Museum of Botany, Glasnevin.

Open Free, daily, at 12 o'clock, and closed at six o'Clock, P. M., from 1st April to 30th September; and 4 o'Clock, P. M., or Sunset, from 1st October to 31st March. The Conservatories are open at 1 o'Clock, P. M., and closed one hour earlier than the time for closing the Garden.

On Sundays the Garden is open at 2 o'Clock, P. M. The Conservatories are open at 2½ o'Clock, P. M.

Persons producing Members' Orders are admitted free at any time.

IV.—Museum of Natural History,

Illustrative of Zoology, Mineralogy, Geology, and Ethnology.

Open Free on Mondays, Wednesdays, Thursdays, and Saturdays, at 11 o'Clock, A.M., and closed at 5 o'Clock, P. M., from 1st April to 30th September; and at 3 o'Clock, P. M., from 1st October to 30th March; also on the Evenings of Mondays and Thursdays, from 7½ to 10 o'Clock.

V.—School of Art.

Open from 1st October to 31st July in each year for instruction in Elementary and Advanced Drawing, Figure and Landscape Painting, and in Mechanical and Architectural Drawing.

Classes for Ladies and Gentlemen.—From 10 o'Clock, A. M., to 3 o'Clock, P. M., daily, Saturdays and Sundays excepted. Fees—12*s.* to 60*s.* per Session of 5 months.

Classes for Artisans, etc.—*Females*—From 10 o'Clock, A. M., to 12 o'Clock on the Mornings of Tuesdays and Thursdays. *Males*—From 7 to 9 o'Clock, P. M., on the Evenings of Mondays, Wednesdays, and Fridays. Fees—From 1*s.* 6*d.* to 3*s.* per month, and from 9*s.* to 12*s.* per Session of 5 months.

Prospectuses to be had on application.

☞ *Prizes are awarded Annually at Examinations and Exhibitions.*

VI.—Library,

Which contains about 62,000 volumes, is open daily (Sundays and holidays excepted) from 10 o'Clock, A. M., to 10 o'Clock, P. M.

Any person having a recommendation from a Member, or who may have obtained permission from the Library Committee, is admitted to read in the Library.

Members have the privilege of borrowing a limited number of books.

The Conversation and Reading Room, which is provided with a large collection of Periodicals, including Newspapers, and in which all the recently purchased Works remain for one Month, is set apart for the exclusive use of the Members.

The Journal of the Royal Dublin Society is sent in Exchange for the Transactions and Publications of the following Institutions, &c.:

Royal Acad. of Sciences, Amsterdam.
Natural History Society, Belfast.
Chemico-Agricultural Society of Ulster, Belfast.
Royal Academy of Sciences, Berlin.
German Geological Society, Berlin.
Imperial Acad. of Sciences, Bordeaux.
American Academy, Boston.
Natural History Society, Boston.
Institution for the Advancement of Science, Liter., and the Arts, Bristol.
Academy of Sciences, Brussels.
Geological Museum, Calcutta.
Philosophical Society, Cambridge.
Mechanics' Institute, Clonmel.
Royal Society of Science, Copenhagen.
Royal Institution, Cork.
Royal Cornwall Polytechnic Society, Falmouth.
Academy of Sciences, Dijon.
Royal Irish Academy, Dublin.
Trinity College Library, Dublin.
College of Physicians, Dublin.
Royal Geological Society of Ireland.
Dublin Natural History Society.
Geological Survey of Ireland, Dublin.
Royal College of Surgeons, Dublin.
University Philos. Society, T. C. D.
Statistical Society, Dublin.
College of Science, Dublin.
Royal Society, Edinburgh.
Highland Agricul. Society, Edinburgh.
Wernerian Society, Edinburgh.
Society of Arts, Edinburgh.
Advocates' Library, Edinburgh.
Die Königlich Sachsischen Gesellschaft der Wissenschaften zu Leipsig.
Society of Physics and Natural History, Florence.
Institution of Engineers, Glasgow.
Society of Physics, Genoa.
Société Vaudoise des Sc. Nat., Lausanne.
Geological and Polytechnic Society of the West Riding of Yorkshire, Leeds.
Philosoph. and Literary Society, Leeds.
Historic Society of Lancashire and Cheshire, Liverpool.
Literary and Philos. Society, Liverpool.
British Archæological Society, London.
Royal College of Surgeons, London.
Royal Society, London.
Geological Society, London.
Linnean Society, London.
Royal Geographical Society, London.
Civil Engineers' Institute, London.
Royal Asiatic Society, London.
Zoological Society, London.
Royal Agricultural Society of England.
Statistical Society, London.
Pathological Society, London.
Royal Astronomical Society, London.
Department of Science and Art, London.
Great Seal Patent Office, London.
Society of Arts, London.
Geological Survey, London.
Royal Institution, London.
London and Middlesex Archæol. Society.
British Museum.
King's Inns Library, Dublin.
tional Association for the Promotion f Social Science.
iété Linneen de Lyons.
La Société Imperiale d'Agriculture, d'Histoire Naturelle, et des Arts Utiles, Lyons.
Academie Imperiale de Lyons.
Literary and Philosophical Society of Manchester.
The Royal Institution, Manchester.
Geological Society, Manchester.
Somersetshire Archæological and Natural History Society.
Northampton Architectural Society.
Philosophical Institute of Victoria, Melbourne.
Public Library, Melbourne.
Imperial Institute of Science, Milan.
State Survey and Univ., Missouri, U.S.
Academy of Science of St. Louis, Missouri, U. S. A.
Imperial Institute of Science, Modena.
Royal Academy of Science, Munich (2 copies.)
Das Bibliothekariat der K. B. Academie der Wisschschaften, Munich.
Editors of Silliman's Journal of Science and Art, New Haven.
Bodleian Library, Oxford.
Ashmolean Society, Oxford.
Ecole Polytechnique, Paris.
Geological Society, Paris.
L'Ecole Imp. des Mines, Paris.
L'Academie des Sciences de l'Institut Imperial de France, Paris.
Jardin des Plantes Bibliotheque, Paris.
Sociétés Savantes de la France et des l'Etrangés, Paris.
American Philosophical Society, Philadelphia, U. S.
Natural History Society, Philadelphia.
Plymouth Institution and Devon and Cornwall Nat. Hist. Society, Plymouth.
Literary and Historical Society, Quebec.
Academy of Sciences, Rouen.
Imperial Academy, St. Petersburgh.
Central Physical Observatory of Russia, St. Petersburgh.
Royal Academy of Science, Stockholm.
Société des Sciences Naturelles de Strasbourg.
Canadian Institute, Toronto.
University College, Toronto.
Academy of Sciences, Toulouse.
Royal Academy, Turin.
Royal Industrial Museum, Turin.
Michigan State Agricultural Society, Lausing, Michigan, U. S.
Wisconsin State Agricultural Society, Wisconsin.
Royal Soc. of Sciences, Upsala, Sweden.
Venetian Society of Science, Literature, and the Arts, Venice.
Verein für Vaterländische Naturkunde, Stuttgart.
Imperial Academy of Sciences, Vienna.
Royal Zoological Society, Vienna.
W. Haidinger, of Vienna, as Editor of the "Jahrbuch der K. K. Geologischen Reichsanstalt."
Smithsonian Institute, Washington, U. S.
Imp. Reg Instituto Veneto de Scienze, &c., Venice.
Deutsche Geologische Gesellschaft, Berlin.

This book should be returned
the Library on or before the last
stamped below.

A fine of five cents a day is incu
by retaining it beyond the speci
time.

Please return promptly.